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BACKUP

LARGE-SCALE SYSTEMS DIRECTIONS- LARGE IBM AND SOFTWARE-COMPATIBLE MAINFRAMES

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LARGE-SCALE SYSTEMS DIRECTIONS
LARGE IBM AND SOFTWARE-COMPATIBLE MAINFRAMES

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I INTRODUCTION

- In 1984, INPUT changed the title of its Residual Value Series to Large-Scale Systems Directions, and this report completes the first set of the new series. The selection of the title was fortuitous, but it has also proved to be fortunate. In attempting to determine IBM's large-scale systems directions, one is filled with the same feeling of awe ~~which~~ that is inspired when viewing the expanding universe from this minor planet. During the past year, IBM literally seems to have been expanding in all directions at the same time. This presented INPUT with the problem of establishing direction (or at least some order) out of chaos.

- The direction problem became especially difficult when attempting to determine IBM software strategies, and it was decided that the concepts of general systems theory (GST) as defined by Ludwig von Bertalanffy would serve as an appropriate means of relating IBM's directions to the inevitable trends of complex computer/communications networks. This methodology was defined and used in INPUT's reports: Market Impacts of IBM Software Strategies and Information Systems Implications of IBM Software Strategies.

- This report ~~was~~ uses the terminology of general systems theory to describe trends in mainframe architecture, and chapter II gives a general explanation of GST concepts. Essentially, the prevailing von Neumann architecture is analyzed, and the emergence of alternatives is d~~e~~iscussed. These alternatives are currently manifesting themselves in the form of supercomputers and data base machines, but they are also immediate threats to the role of the large-scale, general purpose mainframe~~,~~ and its role as defined by IBM systems software.

o Chapter III presents updates of IBM and software-compatible mainframes residual value forecasts, which were contained in: ✓

- Residual Value Forecasts for Large-Scale Systems--December 1983.

- Large-Scale Systems Directions: Mid-Year Update--August 1984.

o In addition, the general methodology used in forecasting residual values is reviewed in Chapter III. It is important that the methodology be understood when employing the forecasts. ✓

II

II GENERAL SYSTEMS TRENDS AND MAINFRAME ARCHITECTURES

A. GENERAL SYSTEMS CONCEPTS

- Earlier this year, confronted with the problem of analyzing IBM software strategies, INPUT found it convenient to apply the concepts of general systems theory. (Market Impacts of IBM Software Strategies and Information Systems Implications of IBM Software Strategies, INPUT, 1984.) Essentially, the theory states that in any complex system progressive centralization, integration, differentiation, and mechanization occur in parallel. These relatively simple concepts are defined as follows: ✓ ✓

    - Progressive centralization: "Leading parts" develop ~~which~~ and dominate the behavior of the system.

    - Progressive integration: The parts become more dependent upon the whole.

    - Progressive differentiation: The parts become more specialized.

    - Progressive mechanization: Parts become limited to a single function.

- ~~While~~ Although ~~T~~he concepts are relatively simple, they provide a convenient framework to view and analyze hierarchical systems of extreme complexity. More importantly, it is INPUT's opinion that an understanding of these

fundamental concepts facilitates the prediction of technological directions in computer systems and the identification~~s~~ of "abnormalities" ~~which~~ that may arise from undue emphasis upon the GST trend at the expense of others. For example, early attempts at standardization of programming languages (a form of mechanization) were doomed to failure because they ignored the nature (and inevitable) trend toward~~s~~ differentiation as a broader user and applications base developed.

- PL/I represented an attempt by a vendor (IBM) to establish a single programming language (function) as a standard. ~~While~~ Although this attempt failed, the parallel effort to establish a mainframe hardware standard has been eminently successful. As we all await the next large-scale mainframe offering {Sierra} from IBM, ~~(Sierra),~~ it is becoming increasingly apparent that the IBM mainframe architecture is less than d~~e~~ivinely inspired~~,~~ and may actually be an "abnormality" with which we have all learned to live.

B. MAINFRAME CENTRALIZATION OF FUNCTION

1. THE VON NEUMANN ARCHITECTURE

- 1984 is the fortieth anniversary of the "von Neumann machine" which fundamentally treats its programs as if they are data in ~~strategy~~ storage. This magnificent conceptual breakthrough permitted the development of general purpose computers as we know them today. Prior to that, instructions were ha~~r~~nd-wired into the processor.

- The general purpose computer provides the "leading part" ~~which~~ that can control both the flow of processing and the flow of data. Conceptually, it facilitates centralization.

- Unfortunately, ~~it~~ the general purpose computer also creates what John Backus (the father of FORTRAN) has described as the "von Ne~~w~~umann bottleneck." Treating instructions and data in a s~~e~~imilar fashion means that data are transferred between storage and the processor one word at a time. Despite the tremendous advances in processor speeds and memory sizes on large general purpose mainframes, ~~they~~ these machines still ~~found~~ funnel data (including instructions) back and forth through this narrow bottleneck.

- During the ~~l~~past year, INPUT has attempted to put large-scale mainframes into perspective.

  - Their primary functions were listed in the Residual Value Forecasts ~~F~~or Large-Scale Systems, December 1983. These functions were defined as: ~~being:~~

    - Heavy computation.

    - Transaction processing against large data bases.

    - Data base management for a computer/communications network.

  - In Large-Scale Systems Directions: Disk, Tape, and Printer Systems, published in March 1984, INPUT projected IBM's probable structuring of distributed data bases. On large-scale mainframes these data structures were:

    - Physical sequential files.

    - VSAM files.

    - IMS/VS and DL/I data bases.

    - DB2 relational tables.

stet comma

- In Large-Scale Systems Directions: Mid-Year Update - 1984, INPUT warned of potential large mainframe performance problems based upon the use of large general purpose mainframes as "data base machines". Some of these performance problems can be directly related to IBM's highly centralized hardware/software implementation of large general purpose mainframes of von Neumann architecture.

o Specifically, the von Neumann architecture is designed for scalar operations and both scientific and commercial computer operations ~~and~~ are dealing with vectors; lists, tables and strings where one word at a time does indeed represent a severe bottleneck. In addition, the IBM System/360 and 370 implementation of von Neumann machine leaves a lot to be desired in the handling of such structure. For example, even before System/360 was announced in 1964, computers with the following features were available:

  - Multiple levels of automatic indirect addressing and address modification which minimized processor access to storage during instruction interpretation and eliminated unnecessary movement of data between the processor and storage (for example during sorting).

  - Automatic memory protection through the setting of limit registers and interrupts on tagged data and instruction words (eliminating the looping required to check table entries, record blocking, and interference between programs and data).

  - Word sizes which permitted more comprehensive addressing schemes (and precision of computation) without resorting to architectural changes such as XA (which has been referred to as "extended accommodation" within IBM). In other words, the 32-bit word size of the IBM 360/370 architecture tends to make the bottleneck more confining.

2. IBM OPERATING SYSTEMS

- SNA is ten years old, but the large IBM host under MVS/XA has continued to epi~~d~~tomize progressive centralization as it strives to maintain its dominance of the network. Precious little function has been distributed from large mainframes over the ~~l~~past ~~ten~~ 10 years, and IBM has been reported as saying that MVS/XA will "run out of gas" by the late 1980s because it will not be able to handle all of the intelligent workstations ~~which~~ that will be linked up by that time.

- Think about the large central host in an SNA network controlling hundreds of intelligent workstations (soon to be thousands), tens of gigabytes of direct access storage (soon to be hundreds of gigabytes or terabytes), tens of megabytes of RAM (soon to be hundreds), and the variety of tasks being performed under MVS/XA, TSO, IMS, DB2, etc. Then think about programs (systems and applications) designed for the von Neumann architecture being passed (along with their data) through the bottleneck between processor and storage. It is a miracle that these centralized systems have progressed to their current size and work at all!

- Yet they remain at the heart of IBM's hardware/software strategy through the 1980s; and, despite reports to the contrary, the large IBM mainframes (and associated operating systems) ~~is~~ are not going to become extinct because of either new hardware (microprocessor) or systems software (UNIX) advances. However, there is no question that IBM has emphasized progressive centralization at the expense of other GST trends, and it is primarily a question of how much control IBM can exercise over the inevitable trends — toward~~s~~ integration, differentiation, and mechanization — ~~which are~~ inherent in computer/communication networks.

C. INTEGRATION TO INFINITY ?

I. SNA--THE HOST WITH THE MOST

- o SNA originally was designed to exercise control over distributed processing by employing relatively, limited function, expensive controllers (3705, 3790) in lieu of minicomputers, which were more cost-effective for distributed processing. Any processing at remote locations would be integrated by becoming host dependent. For example:

  - Timesharing from outside service bureaus and departmental minicomputers was countered by providing a timesharing option (TSO) under what was essentially a batch system (OS/360, evolving over time to MVS/XA). However, individual terminals serviced directly from a central host were not cost-effective compared to interactive terminals serviced from either local or remote minicomputers.

  - When specific interactive applications started appearing in branches of banks, retail outlets, insurance companies, etc., it became apparent that the large number of terminals being serviced could not be supported from remote large-scale mainframes. IBM's initial response was to distribute a few communication functions to the 3705 and minimal processing to the 3790 cluster controller and keep all data bases (and software) centrally located.

  - Eventually some software was developed (DMS was a joint IBM-customer software project) and it became apparent that even at best the 3790 would not support any significant amount of processing. The economics of minicomputers (including IBM's own Series/1) became increasingly apparent, and IBM's response was (and continues to be) the excrutiatingly slow upgrading of the 3705 to the 372X, and the 3790 to the 8100 series.

- The demand for large mainframes mips was fueled by providing terminal access to centralized data bases--especially when the DBMS was IMS.

o The unexpected, rapid development of personal computers (microprocessors) is causing forced integration under the great SNA umbrella. Micro-mainframe links are designed to make the standalone PC (which has already been semi-officially declared dead by IBM) become dependent upon the host for data.

o There are also a multitude of standalone processors (System 36's, 38's, 43XX's, Series/1's and foreign processors) ~~which~~ that must eventually be incorporated in the network at least at the level of document interchange and control, and for data base transfer and backup. Integration under SNA will result in additional host burden.

2. MVS/XA AND MULTIPROCESSING

o MVS/XA is the latest extension of IBM's mainstream operating systems thrust which started with OS/MFT and has gone through numerous iterations. However, it is not an appropriate system to integrate all of the various systems mentioned above. Therefore, it will probably find itself integrated under VM along with a variety of operating systems (including UNIX) at various levels in the processing hierarchy. Piling another level on the software hierarchy only ~~adds~~ places additional burden ~~to~~ on the mainframe.

o As an architectural answer to the demand for more mips, dyadic processors were employed in the 3081, and the 3084 is an MP version of the 3081. There is overhead associated with multiprocessing systems (See Exhibit II-1 in Large-Scale Systems Directions: Mid-Year Update - 1984) and integrating a variety of networked systems through a centralized mainframe with quadruple processors running multiple operating systems under VM is going to result in one big bottleneck in the SNA network.

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- However, this massive centralization seems to be the way IBM is going, because Sierra is being promised with a "single systems view". Indeed, it is INPUT's opinion that integration of distributed data bases requires the emergence of a "leading part" to dominate the behavior of the network; otherwise, chaos is inevitable. Unfortunately, IBM's traditional emphasis upon progressive centralization (without orderly distribution of processing to its proper place in the network) has already resulted in an abnormal burden on host mainframes (many large installations are growing at the rate of 50% per year in required processing power). Therefore, data base integration through the SNA hosts may result in the necessity to distribute processing power in a less than orderly fashion with resulting negative impacts on information quality.

3. THE PROBLEMS OF OFFICE AUTOMATION

- Emerging office systems ~~which~~ that integrate voice, data, text, and images present especially th~~eor~~orny problems for IBM under their heavily centralized, host-oriented strategy. Once paper starts to disappear (or at least be contained) and electronic mail and messages are substituted for some voice communications, a new level of reliability/availability/serviceability is required. And, regardless of improvements ~~which~~ that have been made, IBM mainframe hardware/software RAS does not compare favorably with, let's say, an electronic switching system for AT&T communications.

- In addition, performance of general purpose hardware/software systems, in terms of the number and cost per terminal serviced, has never compared favorably with systems designed specifically for the communications environment. Theoretically, the operator at the intelligent workstation should not have to be concerned about where data or information is located, but there is going to be a big difference in responsiveness when it is located on the LAN and when it is on the mainframe (even if the mainframe is in the same building).

- The fact that a request forwarded to the mainframe may require searching an enormous data base will be immaterial to the new class of users. Consistency of response is extremely important in an interactive environment and anything going through the mainframe bottleneck is going to be subject to delay.

- There is also a question of cost and billing. Data and documents obtained from the central storage facility (mainframe) are going to be substantially more expensive than those stored, produced and retrieved on the LAN.

- It is little wonder that IBM is approaching LAN's cautiously. The~~ir~~ e integration ~~with~~ mainframe under SNA is going to expose price performance imbalance of substantial proportions.

o Office~~s~~ systems will also expose the technological weaknesses of the mainframes ~~which~~ that support them. For example, integrated electronic filing systems incorporating optical disk are beginning to appear Mean while IBM is supporting, Scanmaster I off of mainframes.

- The cost of storing images on optical disk versus magnetic disk is going to be lower by at least an order of magnitude. (See Exhibit II-4 in Large-Scale System~~s~~ Directions - Disk, Tape, and Printer Systems, INPUT 1984).

- In addition, the cost of image processing on large mainframes is going to expose not only the "von Neumann bottleneck", but also the "virtual bottleneck" of page size. An MVS page won't hold a picture (image) - it will require at least ~~ten~~ 10 of them.

✓

4. THE "VIRTUAL BOTTLENECK"

- The overhead of virtual storage systems has been largely ignored in recent years, but there is little question that it has contributed to the insatiable demand for processing power. It is not our intention to rehash the arguments concerning the benefits and costs associated with VS except to state that both technology (in terms of large, cheap main memory) and the role of large central mainframes have changed considerably since VS was determined to be the preferred scheme for memory management.

  - Because many programs requir~~es~~ing heavy computation demonstrate "locality of reference" within their ~~wire~~ inner loops and within their arrays of data, the cost of paging is not nearly so important as the "von Neumann bottleneck" in such scientific computation.

  - However, commercial application requiring sorting, table searching, and random access to large data bases do not exhibit locality of reference in either their program structure or data accessing. The use of host mainframes as data base machines requires precisely this type of processing, and page size (and paging management) becomes a very real "virtual bottleneck".

- It does not appear that IBM intends to change its current 308X, VM/MVS/XA-oriented architecture in either Sierra or Summit. However, it is INPUT's opinion that rapid off-loading of the mainframe through differentiation and mechanization of function may prove necessary if the host is to fulfill ~~the~~ its proper role in the emerging distributed data base environment.

D. DIFFERENTIATION OF FUNCTION

I. THE CURRENT ARCHITECTURAL ENVIRONMENT

- Before proce~~ss~~eding to describe the inevitable GST trends toward~~s~~ differentiation and mechanization of function, it is important to recognize "abnormality" ~~which~~ that has been created by IBM's past (and continued) reluctance to distribute processing on either an architectural or geographic basis. Exhibit II-1 depicts IBM's emphasis upon centralization, and the pressures ~~being~~ created by the current necessity to integrate personal computers, decentralized small business systems and minicomputers, and disparate office automation products ~~is depicted in Exhibit II-1.~~ ✓ II-1

- The IBM strategy is to get all of the sources of data and information integrated at some level under the highly centralized, host-oriented, SNA umbrella. The large mainframe becomes the "leading part" upon which all of the subsidiary parts become dependent for data and information interchange. stet ( ) (See Exhibit II-2 in Large-Scale Systems Directions: Mid-Year Update ~~- 1984~~ for the services provided by large host, data base machines.)

- The problem is that the host hardware/software architecture will create an expensive, central bottleneck ~~which~~ that may not be capable of providing adequate service to the dependent parts of the system. When performance problems have arisen, the solution has been to dedicate systems based on applications: production versus development, batch versus interactive, batch/production versus data base, and now data processing center versus information center. From the vendors' point of view, this is an ideal "solution" for the following reasons:

    - Multiple systems are not as effectively used in terms of both processors and storage (more hardware sales).

- Systems software must be duplicated (more software sales).

- Performance problems (including reliability, availability, and serviceability) are obscured.

o Unfortunately, from the users' point of view, the additional costs go above and beyond the direct hardware/software expense.

- each additional console (system) results in added costs in terms of overhead (flow space, lighting, air conditioning, plumbing, etc.), systems software personnel, operations personnel, and general expenses associated with coordination and management of multiple systems (even if they are on the same site).

- Differentiating the users' applications systems by assigning them to hardware/software clones of the bottleneck is expensive, and it doesn't solve the problem. It merely creates the requirement for a new level of centralization and integration. The solution is to differentiate and mechanize the functions of the bottleneck.

2. VECTOR, ARRAY, AND MATRIX PROCESSORS

o The need to break the von Neumann bottleneck has long been recognized by those concerned with the development of supercomputers for heavy scientific computation, and for many specialized applications in the federal government. In addition, the need to give a boost to the general purpose mainframe has long been recognized by the availability of attached scientific processors, which have been referred to as the "poor man's supercomputer." Even IBM has recognized and addressed this need with the IBM 3838.

o This year ~~has seen~~ both Amdahl and NAS announced supercomputers ~~which~~ that can be attached to, or be frontended by, their IBM software compatible mainframes. Both companies anticipate "commercial" applications ~~which~~ that will

re~~ac~~quire heavy computation, but the systems differ substantia~~b~~lly in their capabilit~~y~~ies.

- The Amdahl 1100 and 1200 Vector Processors have rated speeds of up to 267 megaflops (millions of floating point instructions per second) and 533 megaflops respectively, and with purchase prices of $9.2 million and $13.7 million.
    - These processors truly qualify as supercomputers and are obviously designed to compete in that marketplace.
    - The ability to translate (and subsequently optimize, existing FORTRAN programs written for Amdahl (and IBM) mainframes implies that current applications of multiple Amdahl 58XX or IBM 308X systems might grow sufficiently to warrant such processing power. ~~but~~ This appears doubtful, though ~~since~~ the power differential is so great. (Megaflops on the vector processor cannot be compared with mips ratings on an IBM-compatible mainframe running under MVS: the applications throughput on the vector processor would be substantially greater than the megaflops/mips ratio would indicate.)
    - The increased cost of the Amdahl 1100 and 1200 (maintenance alone runs $35,000 and $51,000 per month, respectively) precludes incremental growth from existing applications: The justification must be in new applications (or agaisnt existing supercomputers).
- NAS, on the other hand, announced the AS/9100 rated at 28 megaflops and sell~~s~~ing for $300,000-$600,000 when added to NAS AS/9000 mainframes (the high end being for multiprocessor systems). The AS/9100 has been billed as an "entry-level supercomputer" ~~which~~ that outperforms IBM 308X series uniprocessors by 14-fold) for vector processing.

        - At that price-performance level it is targetted more at current attached scientific processors such as the IBM 3838, which it is reported to outperform by approximately three to one for vector processing.

        - Therefore, current FORTRAN workload could be adapted to run on the AS/9100 and could result in substantially better performance than on a machine of von Neumann architecture.

        - There is a FORTRAN preprocessor ~~which~~ that allows conventional scalar code to be translated to vector code "without programmer intervention", so it would theoretically be possible to differentiate scientific applications for running on the specialized processor.

        - Depending upon the mix of workload, the AS/9100 provides a means of relieving the current and anticipated burden on large general purpose mainframes.

    - Despite having translators for scalar FORTRAN, the general issue of languages and efficient compilers for vector processors (or array processors) has not really been addressed by either Amdahl or NAS. In addition, using an IBM-compatible, MVS-oriented mainframe to handle the scheduling of the vector processor makes it subject to a certain portions of the overhead, and cost associated with the large, general purpose mainframe.

- In addition to the vector processors for backending IBM-compatible mainframes, it is worth mentioning that an additional level of differentiation is possible by isolating the basic "matrix-matrix multiplication" functions on a matrix computer. During 1984, GuilTech Research Company (GRC) demonstrated the SC-533, a matrix computer capable of Giga computation

rates on fixed point operations (GOPS: 1,000,000,000 multiplies or adds per second) and 533 megaflops on floating point. The system is designed to interface to VAX, Cray, and ~~an~~ Perkin-Elmer hosts; and ~~to~~ "networks" and "industry standard mass storage systems"). Since matrix processing reduces the required data rate for a given computation, balance can be achieved between processing and ~~data rates even~~ I/O even at the data rates on minicomputer channels. ~~processing - I/O balance can be achieved even on at minicomputer channel rates (or on a broadband network presumably).~~ The SC-533 is scheduled for delivery to beta-test sites in 1985 with production units available in 1986. The general architecture of the system is depicted in Exhibit II-2. ✓

II-2

- The host serves primarily as a "data funnel" and not as a computational processor.

- The SCU (Scalar C~~e~~ontr~~a~~ol Unit ~~Limit~~) executes the user's applications program, and, under control of the system executive, sequences and synchronizes the operation of the MPU (Matrix Processing Unit), VPU (Vector Processing Unit) and host I/O.

- The VPU is a standard commercial array processor (30 megaflops) ~~which~~ that compl~~i~~ements the matrix multipl~~y~~ication capabilities of the system with vector arithmetic necessary for many algorithms.

- The MPU performs the kernel operation of the matrix multiplication.

- All data and control communications (~~H~~host to SCU, SCU to MPU, and SCU to VPU) occur via the memory, which i~~n~~s a minimum of 16 M-bytes, and all of the processing units operate in parallel.

- GRC intends to provide various software development features to permit user programs to be "matrixized" including ~~car~~ an optional, off-line, software development tool for program development, debug, and simulation.

- The SC-533 represents the functional differentiation of an applications set (matrix-matrix multiplication), the architectural differentiations of the hardware system (host, SCU, VPU, MPU), and the necessary software differentiation (both operational and development) to make effective use of the system.

- Therefore, a wide variety of "solutions" for the von Neumann computational bottleneck ~~are~~ is becoming available. From the perspective of the large IBM host-oriented network, a variety of configurations ~~are~~ is possible (Exhibit II-3), but they have one thing in common: the general purpose mainframe serves as a data manager and processing schedules for the specialized processors.

  A sample of these configurations is depicted in II-3

3. DATA BASE COMPUTERS

- Serving as a data manager for heavy computation is not the same as serving as a data base manager for large data bases. The volumes of data for scientific computation may be quite large, but they are normally reduced prior to heavy computation~~, and~~. Also, these data are normally represented by one or two-word values (32 or 64 bits). The management of large data bases, on the other hand, results in complex structures of variable length data. The manipulation and control of these data structures also represent a substantial burden for the von Neumann architecture.

- Fortunately, many of the data management problems reduce to the processing of one and two-word values in terms of indices, pointers, and sort keys. In addition, the structures of these data ~~tend to~~ lend themselves to vector processing (regardless of whether they are called tables, lists, or directories) and eventually even to multidimensional matrix processing (for more complex data structures, including images). The primary difference is that data base management requires comparisons (logical operations) rather than conventional arithmetic.

- Unfortunately, while the need for fast arithmetic has been readily apparent in many scientific problems ~~which~~ that simply can't be solved without ever-larger computers, the heavy processing requirements associated with large data bases (and complex data structures) have been virtually ignored by computer architects. ~~In addition~~ Also, ~~the additional~~ user data base manage~~ment burden INPUT foresees is not very clearly understood by user data processing management~~rs do not clearly understand the additional data base management burden that INPUT foresees even though they are confronted with massive mainframe upgrades with each "advance" along the road to c~~o~~entral, corporate data bases.

- Nevertheless, the need for data base machines to support relatively new data base structures--specifically the relational model--ha~~ve~~s been recognized as soon as relational data base systems got out of the laboratory and university and into the commercial environment. Britton Lee's Intelligent Data ~~B~~base Machine (IDM) was introduced in 1981 specifically to suppo r t a full-blown relational DBMS. (To quote David Britton: "~~...~~We had to ship the hardware that would make it perform.) The IDM operates as ~~"~~a global data base resource to mainframes, minis, and microcomputers as standalones, in clusters, or on~~e~~ a local area network (LAN~~'~~s).

wp: "We

- The concept of ~~A~~associative memories ha~~ve~~s been ~~kicked~~ around in the research laboratories for ~~twenty~~ 20 years~~,~~ and have finally begun to emerge in the attempts to solve the data base performance problem. ~~They~~ ~~these machines~~ Associative memories fall under the same general category as vector processors, being ~~S~~single-~~I~~instruction, ~~M~~multiple-~~D~~data ~~M~~machines. They can give a substantial performance boost in the data base environment; but it is not clear whether they will be isolated in separate data base machines or used in advanced storage controllers. INPUT~~'s~~ predict~~ion has been~~s that IBM will find it necessary to improve performance of DB2 (even on Sierra), and an enhanced controller is a good bet.

- INPUT has also predicted that a "sort box" would be developed to improve DBMS performance. This particular prediction goes back ~~to~~ seven years, ~~ago~~ when IMS was just beginning to hit the large mainframes. IBM has never done anything along this line, because ISM performance has been extremely

effective in forcing mainframe upgrades. However, at the National Computer Conference in Las Vegas (July 1984), the Japanese fifth-generation project ~~made~~ prompted two announcements:

- The sequential inference machine (SIM), which was described as a parallel-multiprocessing machine, was announced. (This system should not be confused with the large-scale parallel processors described above; it is a prototype personal computer with the power of a Decsystem-20 Model 2060.)

- A relational data base machine called Delta was announced in support of SIM. It was described as a "special engine for merging and sorting data."

o The differentiation of function for the management of data will become increasingly necessary as data bases grow in size. The development of these data base engines will unquestionably take many forms, but they will closely parallel the sample processor configurations for heavy computation (see Exhibit II-3). The large mainframe will be left with the role of traffic cop on the network ~~which~~ and will be handling the flow of data and information among intelligent terminals (users), processors, and data bases.

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4. NETWORK MANAGEMENT

o This remaining function looks more like an electronic switching system than ~~it~~ ~~does~~ a general purpose mainframe. ~~It~~ Network management must:

- Be highly reliable.

- Provide routings, "busy ~~originals"~~ signals," messages on use, etc.

- Maintain directories of subscribers, terminals, processors, and data bases.

- Provide billing for use.

- This is the area of conflict between AT&T and IBM, both must compete against the others past strengthes. However, we are already beginning to see integration of communications functions (voice, data, and image), and therre is agreement that large mainframes operating under MVS/XA were not originally designed for the interactive environment. On the other hand, UNIX was not designed to handle the management of large data bases or complex scheduling problems.

- Both new hardware and new software ~~is~~ are going to be required before the proper management of networks, including the currently confused LANs is possible. However, for our purposes the main point is that ~~there is no question that~~ all services will not be funneled through the bottleneck of the large mainframes.

E. MECHANIZATION AND MICROS

- Just as major functions (computations, data base management, network management) will tend to become differentiated into more specialized hardware/software systems, the mere routine fucntions of general purpose mainframes will tend to become mecahnized.

- Language interpretations, compilation and error checking will be performed at the intelligent workstations before moving onto the network. Languages will continue to proliferate, but terminals will tend to become more specialized with many translators, interpreters, and compiles built ~~with~~ into the hardware. For example, a scientist dealing with matrix-matrix multipication will have an appropriate algebraic language built into ~~his~~ the termianl, and some one using the query facility for DB2 will also have a specialized terminal. Neither would require intermediate translation prior to transmission to the matrix computer or relational DBMS cap

- As knowledge-based systems develop, the integration of hardware, software, and knowledge-base will result in a fully mechanized (single-function) system~~s~~ for the use of the operator. For example, a doctor will have a system for diagnosis at the office; the system ~~which~~ will be for that purpose alone. She or ~~He~~ will keep track~~s~~ of the ~~his~~ stock portfolio on a ~~his~~ personal computer~~s~~.

- It all adds up to the eventual demise of the large mainframe, but the transition will be relatively slow. In fact, Sierra has now been slipped to 1985, and Summit is still in the works for the late 1980s, but starting in the 1990s there will be more concern for residual values of networks rather than discrete, large-scale systems. ~~INPUT hopes to provide that service.~~

III

III RESIDUAL VALUE FORECASTS

A. FACTORS AFFECTING RESIDUAL VALUE FORECASTS

- Computer equipment residual value forecasts are based upon:
  - Analysis of historical events and trends leading to judgments about whether (and in what way) such trends may change.
  - Predictions by computer industry experts on expected actions by IBM and responding strategies by both software-compatible mainframe manufacturers and vendors of alternate terminal solutions.
  - Analysis of variables affecting residual values as listed in Exhibit III-1.

✓ III-1

- The most visible factor affecting IBM mainframe residual values is the announcement of a new series of large-scale systems. Computer industry experts make a living with such predictions, but actual announcements have never caused violent fluctuations in INPUT's projected residual values.

✓

- When IBM announced the 308XX in early 1984, INPUT issued an executive bulletin on the probable impact on both residual values and the announcement of Sierra (these predictions were reviewed in Large-Scale Systems Directions: Mid-Year Update - 1984) ~~with the~~ and concluded that IBM would not be under any pressure to announce a new series despite the experts' predictions for announcement late this year. The current situation is as follows:

- As the year has progresse~~s~~d, the "experts" ~~are~~ have beg~~inning~~un to push back their predictions. One such expert was recently quoted as stating that Sierra would be announced "perhaps as early (?) as third-quarter 1985," with Summit being announced by the second quarter of 1987.

  - When predictions are changed, it is always good strategy to pretend you were not one of the experts who had been predicting an earlier announcement~~--~~. "perhaps as early" is a good example of a not too subtle attempt at disassociati~~ons~~ng from the rest of the pack.

  - INPUT titled its executive bulletin on the 308XX models Musical Mainframes Again~~...~~", but positioning Sierra and Summit less than two years apart would seem to indicate that IBM has been leaking "information" to the experts, or and that "orchestrated confusion" really reigns.

  - It is obvious INPUT cannot let predictions by outside experts play too important a role in our forecasts of residual values, even though we do read them to complement the more serious analysis.

- One of the sources we use is a poll of what IBM is telling its major customers concerning future announcements. ~~While~~ Although this method does not contribute to significantly more accurate predictions than listening to the experts, it is informative to follow the explanations used when IBM shifts direction. For example, as recently as three or four months ago, IBM was still telling some ~~large~~ major customers that Sierra would be announced in ~~4Q84~~ the fourth quarter of 1984. Now, IBM is leaking information to its customers about "terminal problems" with Sierra and encouraging the purchase of upgrades to the 3084Q.

- Any new system or technology can be reported stet to have technical problems if ~~you don't~~ the manufacturer doesn't want ~~to announce~~ it the system. it is an extremely convenient excuse for ~~the~~ IBM marketing representatives because they cannot be expected to either understand or to explain it, the ~~prob~~ supposed technical problem.

- Technical problems seldom delay announcements when competitive pressures warrant getting a product ~~before~~ in the marketplace. (deliveries ~~, yes;~~ may be delayed, but announcements ~~, no).~~ of new products will not be delayed.)

- Therefore, INPUT does not rely too much on what IBM is telling its customers.

o The truth of the matter is, when anticipating IBM announcements, INPUT relies primarily upon what makes good financial sense for IBM. ~~when we anticipate IBM announcements.~~ That is the secret of ~~our~~ INPUT's early 1984 prediction~~, early in 1984, that~~: "Announcement and/or delivery schedules of Sierra will be delayed to permit the 308XX profitability advantages to be exploited." It is still INPUT's opinion that this is a more plausible reason than "technical problems" for the Sierra slippage. The slippage has been factored into our residual value forecasts.

B. ANNOUNCEMENTS

o The following announcements of significance in forecasting mainframe residual values have been made since the Large-Scale Systems Directions: Mid-Year Update was published.

  - IBM announced price reductions on the 3080 series of mainframes in early September of 1984.

    - The price cuts ranged from 12-16% on processors.

- Memory prices were reduced from $20,000 to $16,250 per megabyte; with 8 M-bytes being reduced from $160,000 to $130,000.

- The prices of 3082 processor controllers were also reduced, with the low-end Model X8 going down to $145,000 from $170,000 and the high-end Model X48 going to $490,000 from $540,000.

- The 3087 Model I coolant distribution unit was cut from $60,000 to $50,000.

- And, the price of I/O channels, was cut from $18,750 to $16,250.

- Within a week, both Amdahl and NAS reacted.

  - Amdahl reduced purchase prices on all 580 series mainframes from 9% to 16%.

  - NAS announced reduced purchase prices on their 8000/9000/9100 series ~~which ranged~~ from 12-% to 16%. stet

o While both NAS and Amdahl were announcing the supercomputers ~~which~~ that were reviewed in the preceeding section of this report, IBM was keeping the pot boiling at the low end of the 4300 line and at the crucial overlap between the high end of the 4300 and 3080 series.

- In mid-September, IBM announced a low-end addition to the 4361 series, the Model 3, priced at $56,500 with 2 M-bytes of main memory. At the same time:

  - The 4321 and 4331 series of mainframes were cancelled, with sharply reduced prices (21% to 37% reductions) being in effect wh~~o~~ile orders were still being accepted (through 12/31/84).

- Existing models of the 4361 were reduced in price by 10%.

- Then in late October, IBM announced the low-end 3083 Model CX and the high-end 4381 Model Group 2.

  - A 3083 Model CX including CPU, 3082 processor controller, 3087 Model 1 coolant distribution unit, 8 M-bytes of main memory and eight channels is priced at $830,000.

  - A 4381 Model Group 3 processor with 8 M-bytes of main memory and twelve standard channels is priced at $825,000.

  - The 3083 Model CX is reported to perform at about 2.5 mips and the 4381 Model Group 3 at between 4.6 to 5.1 mips.

  - If you are wondering why anyone would buy a 3083 Model CX when the 4381 Model Group 3 has nearly two times the price-performance, you are in good company, even IBM doesn't really exp~~erience it.~~ lain

  - However, INPUT believes the answer is clear: you buy the 3083 when you are establishing a major SNA host mode (it can grow to a 3084Q if you like), and you put in a 4381 at a mode with more predictable processing requirements (a branch office or manufacturing plant).

  - In other words if you anticipate rapid growth you are going to pay for it--especially until Sierra is announced and large mainframes achieve price-performance more competitive with the mid-range 4300 series.

o Other announcements of general interest include:

- IBM's acquisition of ROLM.

- CDC getting out of the OEM peripherals business; STC filing for reorganization under Chapter II; and Honeywell selecting IBM as an OEM supplier of 3380-type disk systems. It doesn't require a lot of analysis to determine the direction of large-scale disk storage systems, and the whole sequence of events makes us more than a little ~~blue.~~ melancholy. The full impact of the developments will be analyzed in the next Large-Scale Systems Directions: Disk, Tape, and Printer Systems, which will be published in early 1985.

- Amdahl has demonstrated substantial activity in the software area recently~~:~~

  - Improved delivery schedules on XA for 580 dual processors ~~was~~ were announced in August (from the originally scheduled delivery ~~in~~ time of the second quarter of 1985 to the fourth quarter of 1984~~)~~. ~~2Q85 to 4Q84)~~

  - Amdahl has announced ~~An~~ agreement to market Ingress (a relational data base management system from Relational Technology) under UTS (Amdahl's version of UNIX for large mainframes).

  - ASPEN (Amdahl's alternative operating system, which has been under development for several years) ~~while~~ has not officially been announced, but has been ~~talked up~~ spoken of among prospective customers.

  - And, as this report was being completed, a "multiple domain feature" hardware enhancement for the 580 series was announced, which permits two operating systems to coexist on the same uniprocessor or multiprocessor.

- INPUT, in the belief that alternatives to IBM's software strategy were highly desirable, endorsed selective deviations among plug-compatible mainframe vendors years ago; the only question ~~we~~ INPUT have now is whether the window of opportunities has closed.

C. PROJECTED USED MARKET PRICES AND RESIDUAL VALUES

o Exhibits III-2 and III-3 contain projected used market retail values in dollars, and the projected residual values as a percent of vendor list price. It should be understood that, at any given time, three price levels exist: √ III-2 √ III-3

  - "Retail price" is the amount an end user would pay for the equipment.

  - "Dealer price" is the amount a dealer would pay another dealer for the equipment.

  - "Wholesale price" is the amount a dealer would pay to acquire equipment for resale.

  - The dollar spread between levels is a function of the total value of the transaction. For large processors the wholesale price will typically be 80 ~~to~~ 95% of the retail price; ~~and in~~ for smaller processors 70 ~~to~~ 90% is more likely.

- Exhibits III-4 through III-24 graph the range of anticipated values (as a percent of list price) for 1986 through 1990 for the following ~~selected~~ processors: III-4 ↓ III-24

  - IBM 4331-K02, 4341-L02, 4361-K04, 4381-K05, 3083-JX32, ~~A3~~ 3083-EX8, 3083-BX16, 3081-GX16, 3081-KX24, 3084-QX64.

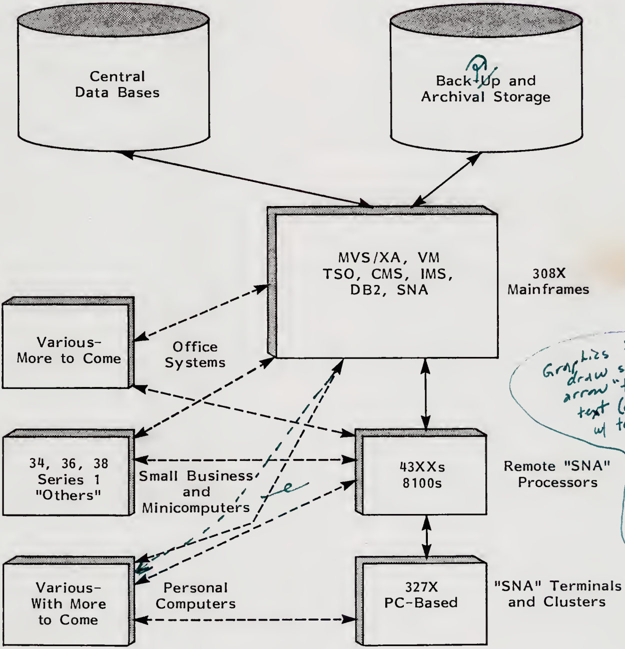
  - Amdahl 5850-24, 5860-24, 5868-32, 5870-32, 5880-64.

  - NAS AS/6630, AS/6660, AS/8023, AS/8083, AS/9050, AS/9070.

U-CLS3

EXHIBIT II-1

IBM CENTRALIZATION AND INTEGRATION


Central Data Bases
Back-Up and Archival Storage
MVS/XA, VM TSO, CMS, IMS, DB2, SNA
308X Mainframes
Various- More to Come
Office Systems
34, 36, 38 Series 1 "Others"
Small Business and Minicomputers
43XXs 8100s
Remote "SNA" Processors
Various- With More to Come
Personal Computers
327X PC-Based
"SNA" Terminals and Clusters

Graphics: draw straight "arrow "through" text (don't join w/ text, though) as is looks like bend has a reason

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EXHIBIT II-2

AN EXAMPLE OF ARCHITECTURAL DIFFERENTIATION

GRC's SC-533

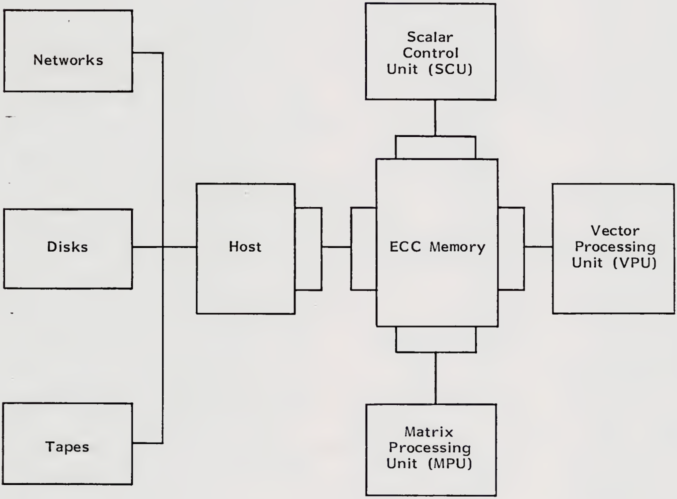
Networks
Disks
Tapes
Host
Scalar Control Unit (SCU)
ECC Memory
Vector Processing Unit (VPU)
Matrix Processing Unit (MPU)

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EXHIBIT II-3

SAMPLE PROCESSING CONFIGURATIONS

(Heavy Computation)

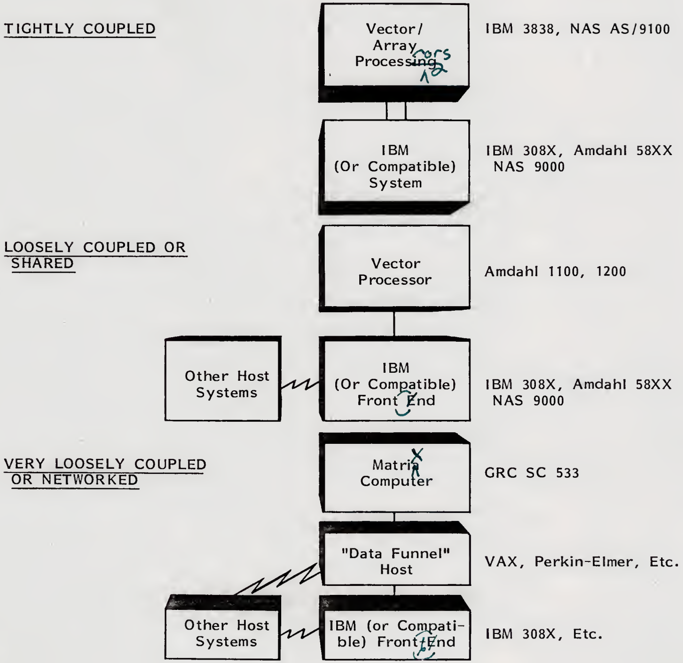
TIGHTLY COUPLED
Vector/Array Process~~ing~~ors
IBM 3838, NAS AS/9100
IBM (Or Compatible) System
IBM 308X, Amdahl 58XX NAS 9000
LOOSELY COUPLED OR SHARED
Vector Processor
Amdahl 1100, 1200
Other Host Systems
IBM (Or Compatible) Front End
IBM 308X, Amdahl 58XX NAS 9000
VERY LOOSELY COUPLED OR NETWORKED
Matrix Computer
GRC SC 533
"Data Funnel" Host
VAX, Perkin-Elmer, Etc.
Other Host Systems
IBM (or Compatible) Front End
IBM 308X, Etc.

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EXHIBIT III-1

FACTORS AFFECTING COMPUTER EQUIPMENT RESIDUAL VALUES

- IBM practices and policies
    - New product announcements
        - Price/performance ratios relative to existing products.
        - Ease of conversions, transitions, and lead time in obtaining new products.
        - Ease of installation and maintenance.
        - Effect on perceptions about IBM's technical direction.
    - Pricing policies
        - Price increases or decreases on existing products.
        - Rental versus purchase break-even ratios.
        - Lease plans and penalty provisions for lease termination.
        - Purchase option accruals.
    - Maintenance policies
        - Availability and cost.
        - Attitude toward other vendor modifications to IBM equipment.
- Alternative equipment services
    - Price/performance of plug (software) compatible alternatives.
    - Third-party leasing options.
- Other variables
    - Environmental support considerations, e.g., electrical power consumption, air conditioning needs, space requirements.
    - Tax considerations, e.g., income tax incentives such as investment tax credit and accelerated depreciation, and also property taxation rates.
    - General economic conditions, e.g., cost and availability of capital and overall demand for computing capacity.

ok?

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EXHIBIT III-2

Projected Used Market Retail Values
~~(Dollars)~~

VENDOR	PROCESSOR MODEL	CURRENT LIST* 11/1/84	ESTIMATED MARKET VALUE* 1985	PROJECTED USED* MARKET RETAIL VALUE AT JAN. 1 OF:				
				1986	1987	1988	1989	1990
IBM	4331-J01	60920	17058	9138	6092	4264	2437	609
	4331-K02	49205	30507	22142	13777	5905	3444	1968
	4341-K01	184500	27675	18450	14760	9225	3690	1845
	4341-L02	312000	65520	46800	34320	21840	9360	3120
	4361-DL3	71500	71500	53625	44330	34320	15730	5720
	4361-ML4	215000	172000	133300	124700	86000	23650	10750
	4381-0M2	540000	459000	437400	361800	243000	86400	43200
	4381-0M3	825000	825000	701250	618750	453750	247500	123750
	3033-N08	1274000	38220	12740	6370	3822	0	0
	3033-U12	1764000	88200	52920	26460	17640	8820	0
	3083-CX8	635000	635000	412750	254000	139700	63500	25400
	3083-EX8	810000	607500	445500	267300	121500	48600	16200
	3083-BX16	1460000	1138800	832200	525600	277400	116800	29200
	3083-JX32	2160000	1728000	1296000	864000	453600	216000	64800
	3081-GX16	2475000	2029500	1608750	990000	495000	297000	123750
	3081-KX24	3365000	2860250	2288200	1514250	807600	504750	235550
	3084-QX64	6010000	5409000	4507500	3606000	2704500	1502500	721200
AMDAHL	470-V7	By Quote	-	-	-	-	-	-
	470-V8	By Quote	-	-	-	-	-	-
	5840-16	1700000	1360000	1020000	646000	289000	102000	17000
	5850-24	2140000	1712000	1284000	834600	385200	171200	21400
	5860-24	2560000	2176000	1740800	1075200	512000	256000	76800
	5867-32	3360000	3024000	2352000	1478400	739200	369600	100800
	5868-32	3690000	3321000	2583000	1623600	811800	405900	110700
	5870-32	3930000	3340500	2751000	1886400	1021800	510900	235800
	5880-64	5040000	4284000	3528000	2520000	1411200	907200	453600

* In dollars

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EXHIBIT III-2 Cont.

~~Projected Res~~

VENDOR	PROCESSOR MODEL	CURRENT LIST* 11/1/84	ESTIMATED MARKET VALUE* 1985	PROJECTED USED MARKET RETAIL VALUE* AT JAN. 1 OF: 1986	1987	1988	1989	1990
NAS**	AS/6620	255000	153000	76500	35700	20400	12750	2550
	AS/6630	341500	211730	119525	61470	27320	17075	6830
	AS/6650	417500	279725	167000	104375	62625	41750	16700
	AS/6660	475000	475000	403750	346750	213750	85500	47500
	AS/8023-8	699000	594150	363480	230670	83880	41940	13980
	AS/8043-8	1067000	853600	586850	373450	160050	85360	42680
	AS/8053-8	1492000	1193600	850440	537120	223800	134280	74600
	AS/8063-8	1905000	1714500	1143000	742950	323850	209550	133350
	AS/8083-16	3074000	2705120	2151800	1321820	614800	430360	245920
	AS/9040-8	1492000	596800	298400	134280	74600	29840	14920
	AS/9050-8	1909000	801780	477250	229080	133630	76360	38180
	AS/9060-16	2308000	1038600	692400	415440	230800	138480	92320
	AS/9070-16	3249000	1624500	1364580	779760	487350	259920	194940
	AS/9080-16	4140000	2152800	1945800	1242000	745200	414000	289800

*Dollars.

**National Advanced Systems (NAS) does not quote processor prices separately; list price on this schedule includes power distribution unit, controller and console, where appropriate.

EXHIBIT III-3

Projected Residual Values as a Percent of Vendor List Price

VENDOR	PROCESSOR MODEL	CURRENT LIST 11/1/84	ESTIMATED MARKET VALUE 1985	PROJECTED RESIDUAL VALUE AS A PERCENT OF VENDOR LIST PRICE VALUE AT JAN. 1 OF:				
				1986	1987	1988	1989	1990
IBM	4331-J01	60920	28%	15%	10%	7%	4%	1%
	4331-K02	49205	62%	45%	28%	12%	7%	4%
	4341-K01	184500	15%	10%	8%	5%	2%	1%
	4341-L02	312000	21%	15%	11%	7%	3%	1%
	4361-DL3	71500	100%	75%	62%	48%	22%	8%
	4361-ML4	230000	80%	62%	58%	40%	11%	5%
	4381-0M2	540000	85%	81%	67%	45%	16%	8%
	4381-0M3	825000	100%	85%	75%	55%	30%	15%
	3033-N08	1274000	3%	1%	1%	0%	0%	0%
	3033-U12	1764000	5%	3%	2%	1%	1%	0%
	3083-CX8	635000	100%	65%	40%	22%	10%	4%
	3083-EX8	810000	75%	55%	33%	15%	6%	2%
	3083-BX16	1460000	78%	57%	36%	19%	8%	2%
	3083-JX32	2160000	80%	60%	40%	21%	10%	3%
	3081-GX16	2475000	82%	65%	40%	20%	12%	5%
	3081-KX24	3365000	85%	68%	45%	24%	15%	7%
	3084-QX64	6010000	90%	75%	60%	45%	25%	12%
AMDAHL	470-V7	By Quote	2%	1%	1%	0%	0%	0%
	470-V8	By Quote	4%	2%	1%	1%	1%	0%
	5840-16	1700000	80%	60%	38%	17%	6%	1%
	5850-24	2140000	80%	60%	39%	18%	8%	1%
	5860-24	2560000	85%	68%	42%	20%	10%	3%
	5867-32	3360000	90%	70%	44%	22%	11%	3%
	5868-32	3690000	90%	70%	44%	22%	11%	3%
	5870-32	3930000	85%	70%	48%	26%	13%	6%
	5880-64	5040000	85%	70%	50%	28%	18%	9%

EXHIBIT III-3 (Cont.)

VENDOR	PROCESSOR MODEL	CURRENT LIST 11/1/84	ESTIMATED MARKET VALUE 1985	PROJECTED RESIDUAL VALUE AS A PERCENT OF VENDOR LIST PRICE VALUE AT JAN. 1 OF:				
				1986	1987	1988	1989	1990
NAS*	AS/6620	255000	60%	30%	14%	8%	5%	1%
	AS/6630	341500	62%	35%	18%	8%	5%	2%
	AS/6650	417500	67%	40%	25%	15%	10%	4%
	AS/6660	475000	100%	60%	35%	22%	15%	7%
	AS/8023-8	699000	85%	52%	33%	12%	6%	2%
	AS/8043-8	1067000	80%	55%	35%	15%	8%	4%
	AS/8053-8	1492000	80%	57%	36%	15%	9%	5%
	AS/8063-8	1905000	90%	60%	39%	17%	11%	7%
	AS/8083-16	3074000	88%	70%	43%	20%	14%	8%
	AS/9040-8	1492000	40%	20%	9%	5%	2%	1%
	AS/9050-8	1909000	42%	25%	12%	7%	4%	2%
	AS/9060-16	2308000	45%	30%	18%	10%	6%	4%
	AS/9070-16	3249000	50%	42%	24%	15%	8%	6%
	AS/9080-16	4140000	52%	47%	30%	18%	10%	7%

*National Advanced Systems (NAS) does not quote processor prices separately; list price on this schedule includes power distribution unit, controller and console, where appropriate.

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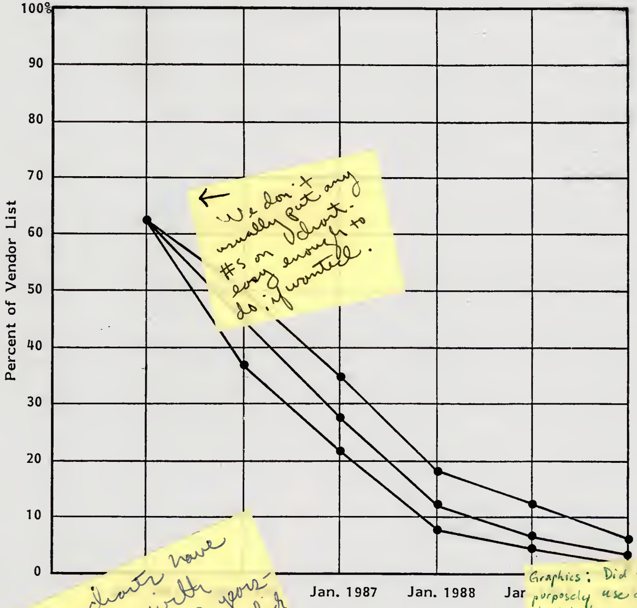
EXHIBIT III-4

RESIDUAL VALUE FORECAST FOR
IBM 4331-K02 PROCESSOR



← We don't usually put any #s on chart. easy enough to do, if wanted.

	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN 199
gn	50%	35%	18%	12%	7%
Expected	45	28	12	7	4
Low	37	22	8	5	2

These charts have been done with Bullets only for years - it's perfectly clear which line is "High", Low etc.

Graphics: Did you purposely use only bullet-type marks for different values?
s. b. □ High
● Expected
△ Low
Also, did author approve omitting % for 1985 in chart?

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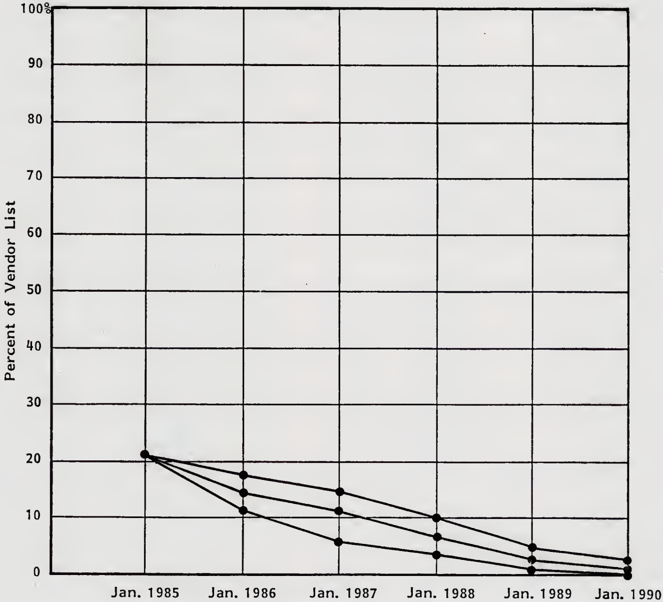
EXHIBIT III-5

RESIDUAL VALUE FORECAST FOR IBM 4341-L02 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	18%	15%	10%	5%	3%
Expected	15	11	7	3	1
Low	11	6	4	1	0

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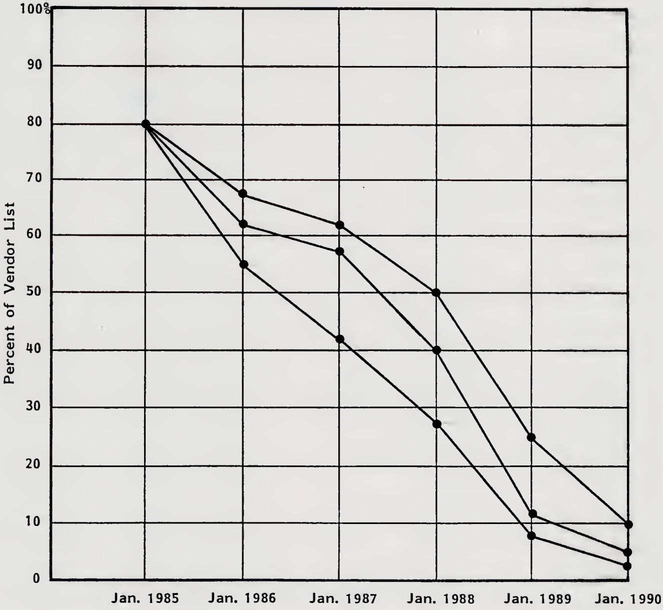
EXHIBIT III-6

RESIDUAL VALUE FORECAST FOR IBM 4361-OK4 PROCESSOR

KO



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	68%	62%	50%	25%	10%
Expected	62	58	40	11	5
Low	55	42	28	8	3

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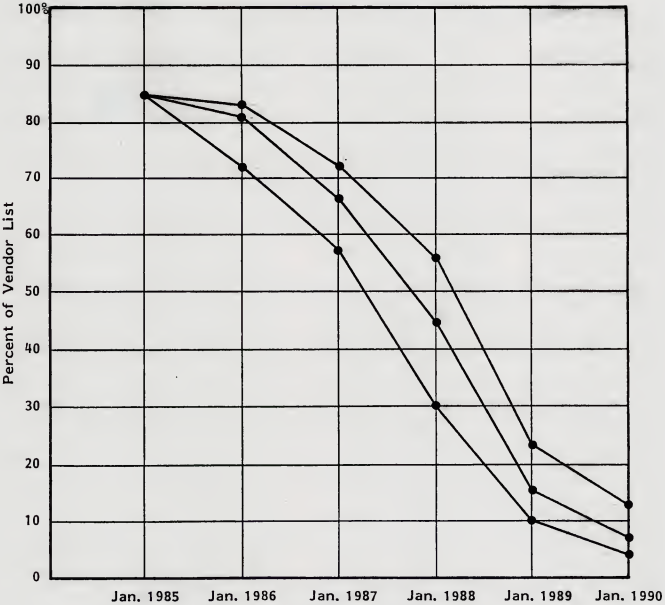
EXHIBIT III-7

RESIDUAL VALUE FORECAST FOR IBM 4381-OK5 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	83%	72%	57%	23%	12%
Expected	81	67	45	16	8
Low	72	58	30	10	5

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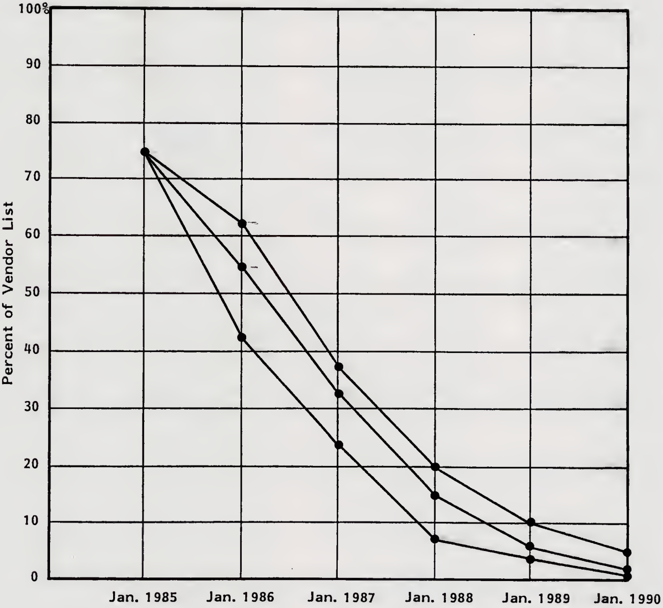
EXHIBIT III-8

RESIDUAL VALUE FORECAST FOR IBM 3083-EX8 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	62%	38%	20%	10%	5%
Expected	55	33	15	6	2
Low	42	24	8	4	1

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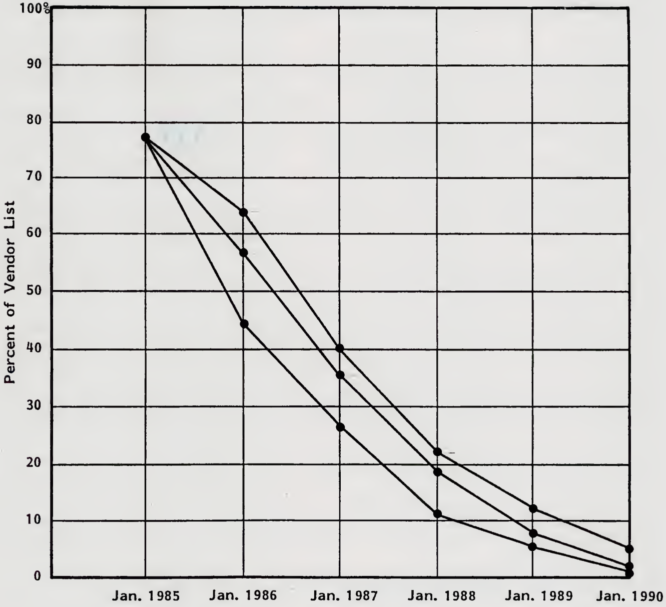
EXHIBIT III-9

RESIDUAL VALUE FORECAST FOR IBM 3083-~~E~~BX16 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	64%	40%	22%	12%	6%
Expected	57	36	19	8	2
Low	45	27	11	6	1

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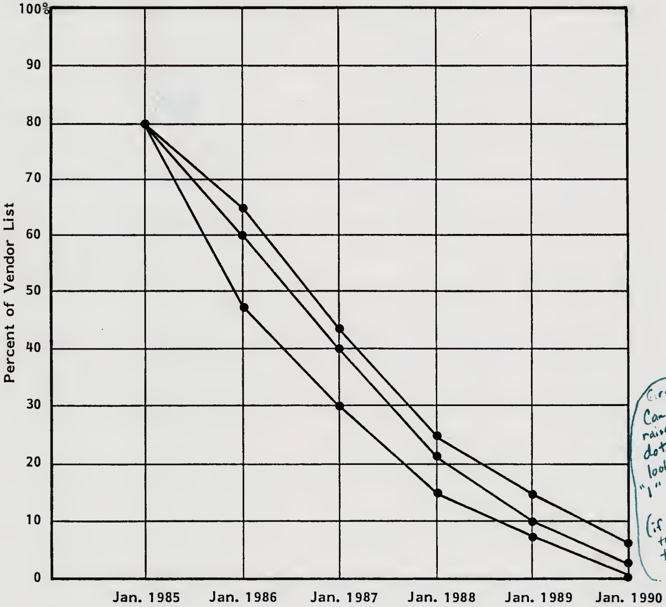
EXHIBIT III-10

RESIDUAL VALUE FORECAST FOR IBM 3083-JX32 PROCESSOR



Graph: Can you raise last dot so it looks like "1" -- not "0"? (if it isn't too much trouble)

PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	65%	43%	25%	15%	7%
Expected	60	40	21	10	3
Low	48	30	15	8	1

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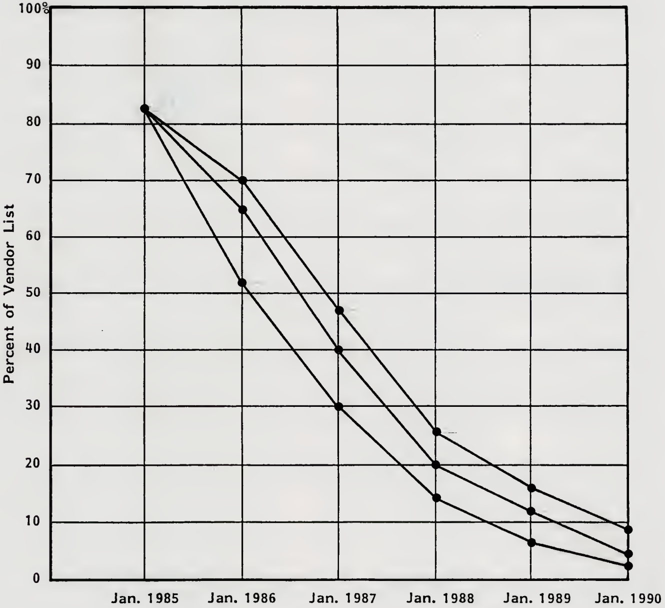
EXHIBIT III-11

RESIDUAL VALUE FORECAST FOR IBM 3081-GX16 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	70%	48%	26%	17%	9%
Expected	65	40	20	12	5
Low	52	30	14	7	3

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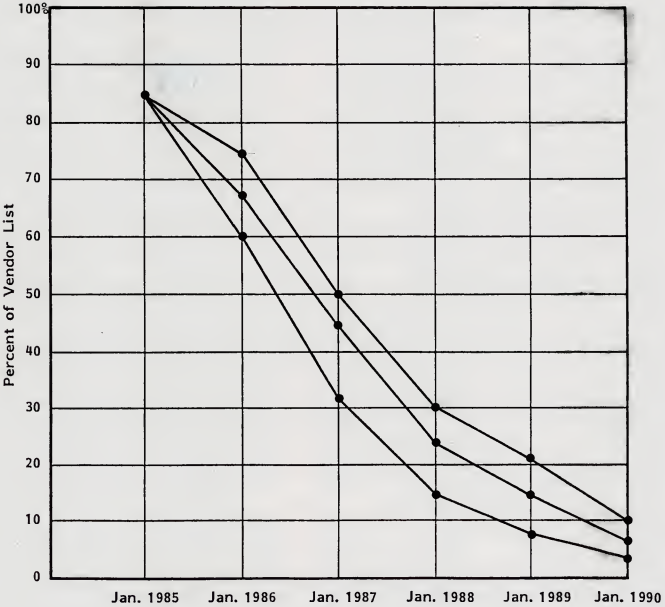
EXHIBIT III-12
RESIDUAL VALUE FORECAST FOR IBM 3081-KX24 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	75%	50%	30%	21%	10%
Expected	68	45	24	15	7
Low	60	32	15	8	4

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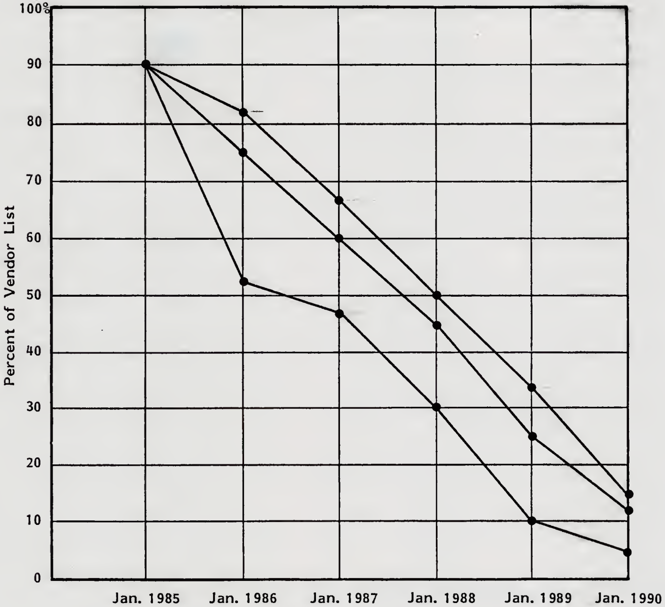
EXHIBIT III-13

RESIDUAL VALUE FORECAST FOR IBM 3084-QX64 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	82%	67%	50%	33%	15%
Expected	75	60	45	25	12
Low	52	48	30	10	5

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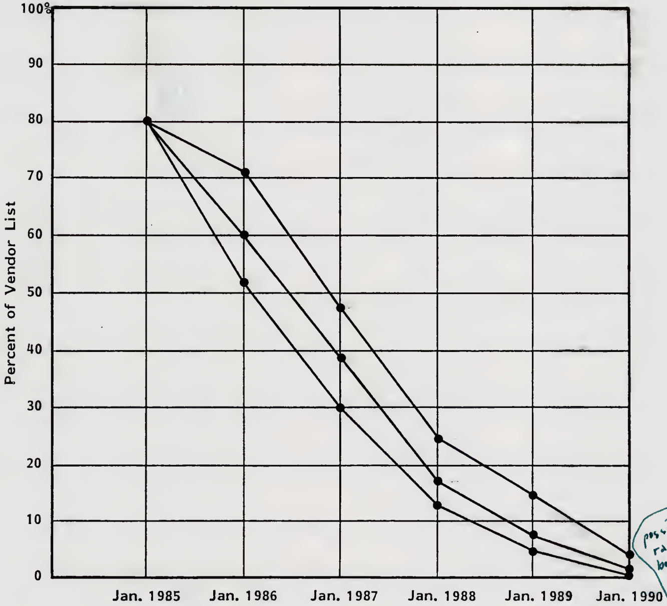
EXHIBIT III-14

RESIDUAL VALUE FORECAST FOR AMDAHL 5850-24 PROCESSOR



possible to raise bottom • so it's not on "0" ?

PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	71%	48%	25%	15%	4%
Expected	60	39	18	8	2
Low	52	30	13	5	1

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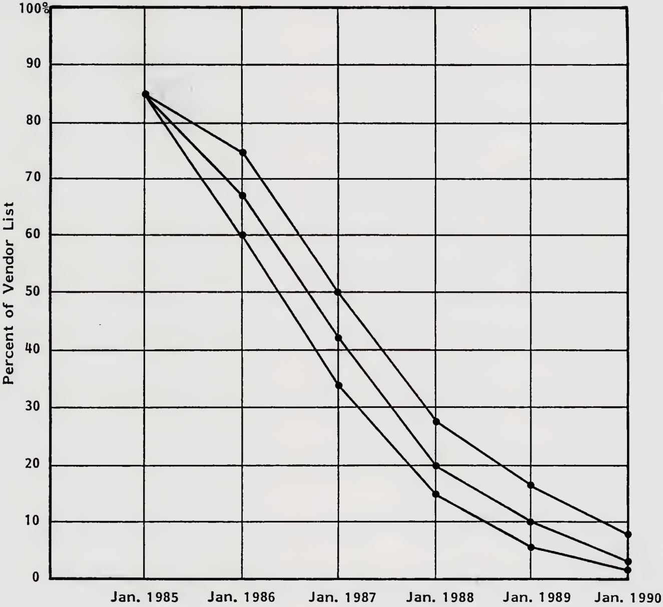
EXHIBIT III-15

RESIDUAL VALUE FORECAST FOR AMDAHL 5860-24 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	75%	50%	28%	17%	8%
Expected	68	42	20	10	3
Low	60	34	15	6	1

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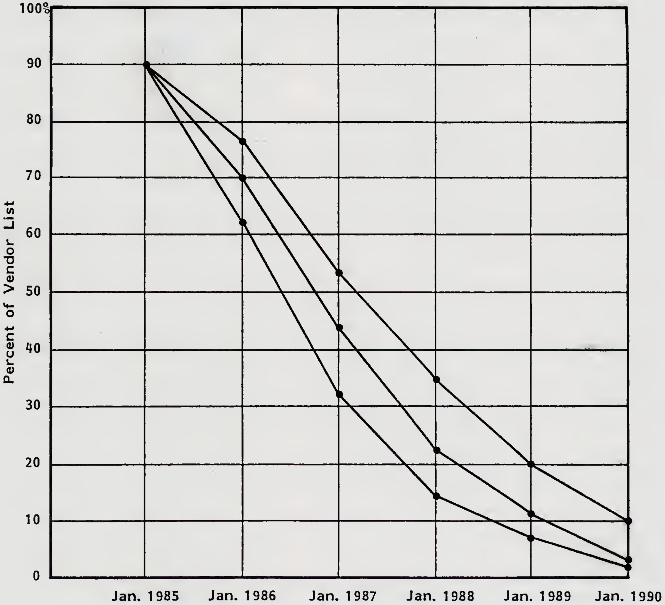
EXHIBIT III-16
RESIDUAL VALUE FORECAST FOR AMDAHL 5868-32 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	77%	53%	35%	20%	10%
Expected	70	44	22	11	3
Low	62	32	15	8	2

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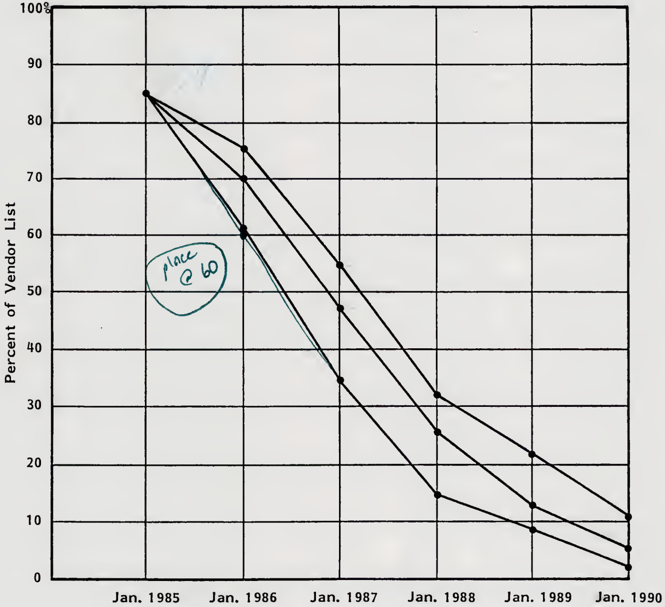
EXHIBIT III-17

RESIDUAL VALUE FORECAST FOR AMDAHL 5870-32 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	76%	55%	32%	22%	11%
Expected	70	48	26	13	6
Low	60	35	15	9	2·

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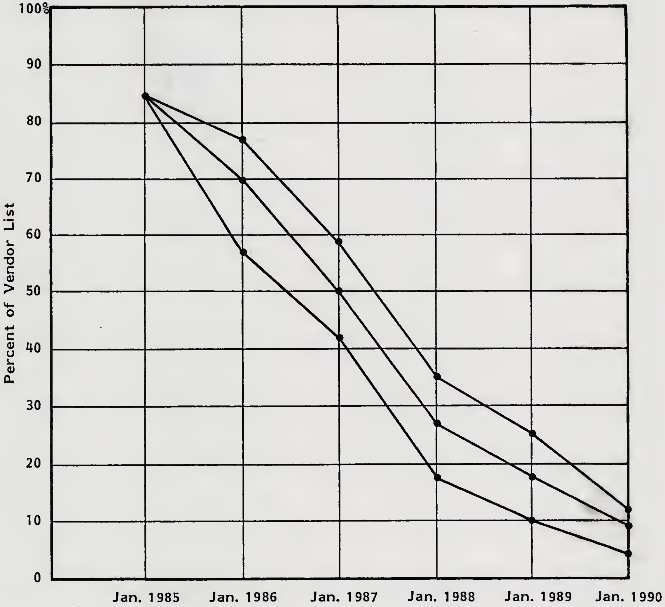
EXHIBIT III-18

RESIDUAL VALUE FORECAST FOR AMDAHL 5880-64 PROCESSOR



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	78%	59%	35%	25%	12%
Expected	70	50	28	18	9
Low	58	42	18	10	4

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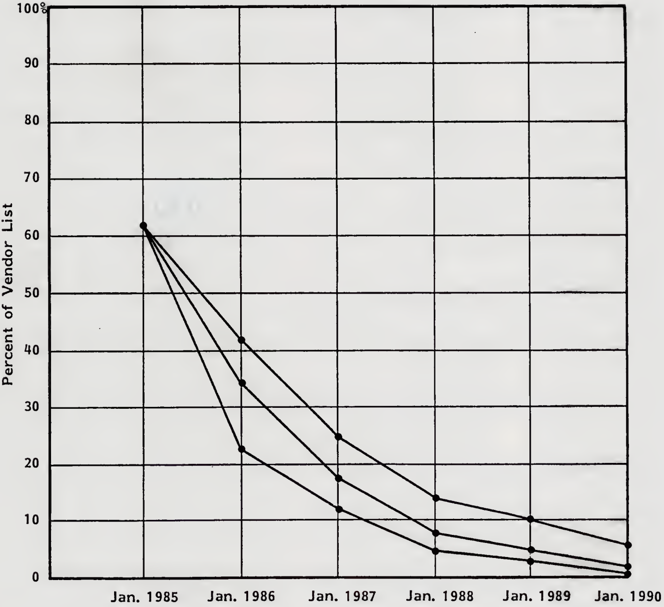
EXHIBIT III-19
RESIDUAL VALUE FORECAST FOR NAS AS/6630



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	42%	25%	14%	10%	6%
Expected	35	18	8	5	2
Low	23	12	5	3	1

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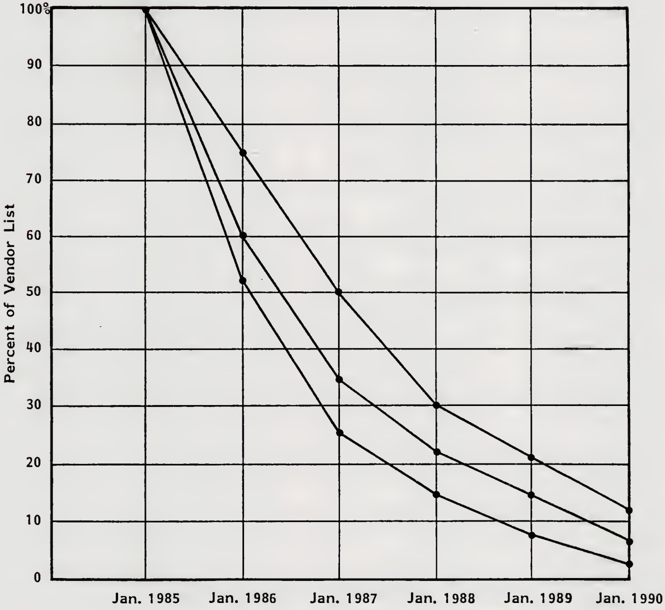
EXHIBIT III-20

RESIDUAL VALUE FORECAST FOR NAS AS/6660



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	75%	50%	30%	21%	12%
Expected	60	35	22	15	7
Low	52	26	15	8	3

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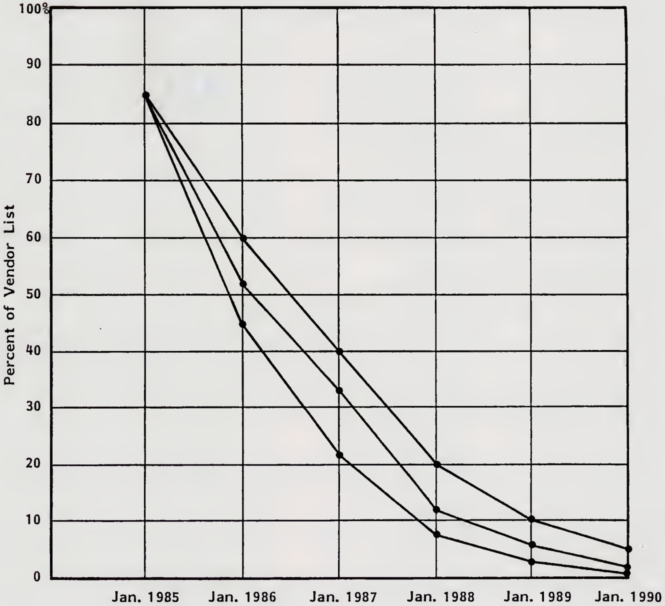
EXHIBIT III-21

RESIDUAL VALUE FORECAST FOR NAS AS/8023



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	60%	40%	20%	10%	5%
Expected	52	33	12	6	2
Low	45	22	8	3	1

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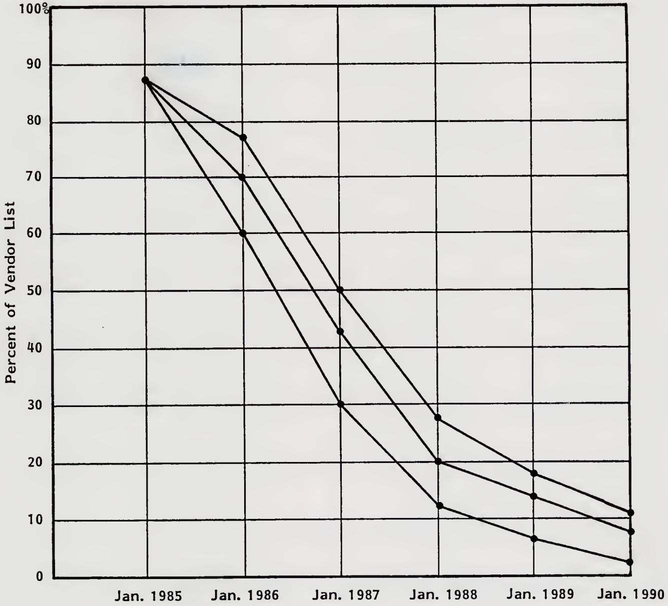
EXHIBIT III-22

RESIDUAL VALUE FORECAST FOR NAS AS/8083



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	78%	50%	28%	18%	11%
Expected	70	43	20	14	8
Low	60	30	12	7	2

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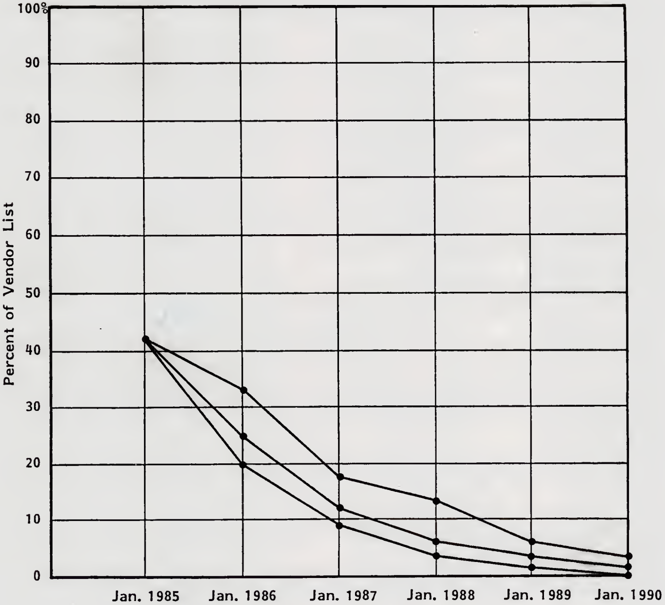
EXHIBIT III-23

RESIDUAL VALUE FORECAST FOR NAS AS/9050



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	33%	18%	13%	7%	4%
Expected	25	12	7	4	2
Low	20	9	4	2	0

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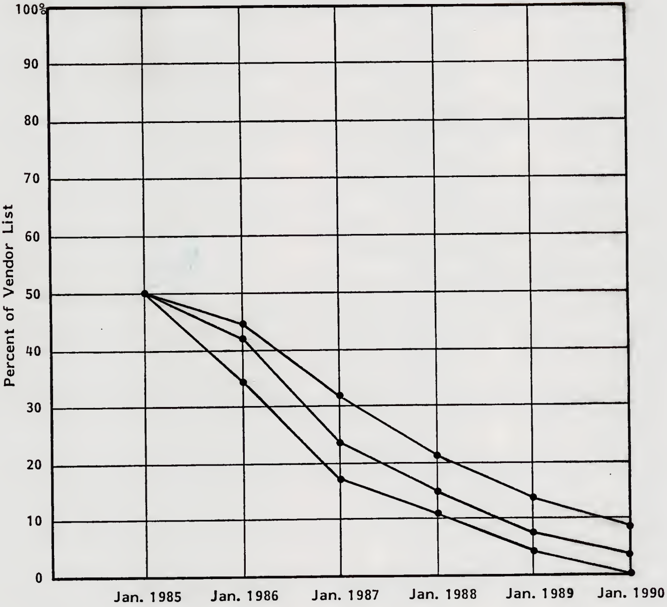
EXHIBIT III-24
RESIDUAL VALUE FORECAST FOR NAS AS/9070



PROJECTED VALUES RANGE	JAN. 1986	JAN. 1987	JAN. 1988	JAN. 1989	JAN. 1990
High	45%	32%	21%	14%	9%
Expected	42	24	15	8	4
Low	35	18	11	5	0

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U-CLS (3)

UCLS-3
Backup

Large Scale Systems Directions:
IBM and Software Compatible Mainframes

I- Introduction 3

II- General Systems Trends and Mainframes Architectures 20-25

A- General Systems Concepts

B- Mainframe Centralization of Function
  1- The von Neumann Architecture
  2- IBM Operating Systems

D- Differentiation of Function
  1- Scalar, Vector, and Matrix Computers
  2- Data Base Computers
  3- Network Management
  4- Electronic Filing

C- Integration to Infinity?
  1 - SNA - The Host with the Most
  2- MVS-XA & Multi-processing
  3- The Problem of Office Automation

E- Mechanization & Micros
  1- Artificial Intelligence
  2- Computer Languages

3 - Frozen Functions

F - The Amdahl 1100 & 1200, and the Future

1 -

III - Residual Value Forecasts 20-25

A - Announcements (except Amdahl 1100 & 1200).

B - Used Market Activity

C - Projected Residual Values

Schedule U-CLS(3)

1- Outline (10/15)

2- Exhibit A (?)

3- First Draft (section II) (11/5)

4- Residual Value Forecasts (Bob) (11/12)

5- Final Draft (11/15)

CONFIDENTIAL

INPUT QUESTIONNAIRE

CATALOG. NO. ☐☐☐☐☐☐☐☐
SIC. CODE ☐☐☐☐☐☐☐
SIZE CODE ☐☐
AREA CODE ☐☐
STUDY CODE ☐☐
DATES ☐☐☐☐☐☐
MM DD YY

STUDY TITLE:
TYPE OF INTERVIEW: ☐ VENDOR ☐ USER ☐ TELEPHONE ☐ ON-SITE ☐ MAIL

INTERVIEWER: Tim Tyler

COMPANY: Mathematica

CO. TYPE:

ADDRESS:

SALES:

NO. EMPL:

INDUSTRY ☐

☐ DISCRETE MANUFACTURING
☐ PROCESS MANUFACTURING
☐ TRANSPORTATION
☐ MEDICAL
☐ SERVICES
☐ UTILITIES
☐ RETAIL
☐ BANKING
☐ WHOLESALE
☐ OTHER
☐ INSURANCE
☐ GOVERNMENT - FEDERAL
☐ GOVERNMENT - STATE & LOCAL
☐ EDUCATION

INTERVIEWS

NAME	TITLE	TELEPHONE NO.
Lori Wite		609 799/2600

SUMMARY

REFERENCES

Mathematica

CATALOG NO. MSSP☐☐☐

VENDOR QUESTIONNAIRE

1. How do you define the productivity problem in the typical IS department?

Traditional Systems Methodology & War between users & Information Systems

a. How can the problem be scoped? Backlog & Process takes a long time... Errors in Planning & requirements

b. How can improvement be measured? Fourth Generation Time... to develop — use in analysis phase... P

2. What do you think are the most promising approaches to improving productivity in systems development and programming?

Fourth Generation... Aid to Systems Methodology...

(Formatted Screen Manager...

how system will look to user...)

(Becoming more appropriate for large systems...)

RAMIS II..

English

vs.

Intellect

3. The major trend in reducing the systems and programming bottleneck has been to get end users more involved in the process. INPUT refers to this as Distributed Systems Development. How do you feel IS departments feel about the following:

a. Information Centers Simple Reports (

Users Excited (IS doesn't like it.)

b. Prototyping Fourth Generation

c. Use of Standalone PCs (for work formerly done by IS)

Afraid of proliferation

CATALOG NO. MSSP☐☐☐

d. Micro-Mainframe Links need to connect . . . Micro-mainframes

4. We would like to get your opinions considering DSD in general. Do you agree or disagree with the following statements:

	Agree	Disagree
It has relieved user pressure on IS	☐	☐
End users are happier	☐	☐
Systems get done faster	☐	☐
Programs Get Done Faster	☐	☐
Backlog has been (or will be) reduced	☐	☐
DSD help IS do its job	☐	☐
DSD is going to cause problems	☐	☐
End users don't know what they are doing	☐	☐
IS Productivity is improved	☐	☐
End-User productivity is improved	☐	☐
Corporate productivity is improved	☐	☐
The system will have to be rewritten by IS	☐	☐

5. What are the main advantages and disadvantages of:

a. Information Centers

Advantages: ______________________

____

Disadvantages ______________________

____

b. Prototyping

Advantages ______________________

____

Disadvantages ______________________

____

c. Standalone PCs

Advantages __________

Disadvantages __________

d. Micro-Mainframe

Advantages __________

Disadvantages __________

6. Past research has indicated that systems maintenance is the most costly part of the systems life cycle. What impact is DSD going to have on maintenance?

① medium → large must retain traditional approaches (documentation), Functional Specs.

unless Throwaway Prototype... [Has horror stories — prototype that never ends

7. What tools and aids are currently being used to facilitate end user systems development? (Ask for both name and vendor)

NAME	VENDOR

Very Large Volumes

Big

CATALOG NO. M S S P ☐ ☐ ☐

8. A great deal of apprehension has been expressed about micro-mainframe links. How serious do you consider the following potential problems?

	Very Serious	Somewhat Serious	Not a Problem	
Data Base Synchronization	☐	☑	☐	
Data Base Integrity	☐	☑	☐	
User Understanding of Data	☐	☐	☑	User [illegible]
Conflicting Reports to Management	☑	☐	☐	
Mainframe Capacity Planning	☐	☐	☐	not locked away
Mainframe Performance Impact	☐	☑	☐	
IS Visability	☐	☐	☐	
Cost to Company	☐	☐	☐	
Impact on IS Budget Go up...	☐	☑	☐	
Systems Quality Doing more	☐	☐	☐	Improve
IS Loss of Control (They will feel it.)	☐	☑	☐	
Data Security/Protection	☑	☐	☐	

Password

MSSP

Backup

9. Which current tools do you feel are most promising for facilitating DSD?

Ramis II - Screen Painter - English...

menu Driven Systems with
MARVEL (mathematics) Just
(developed in Ramis II)

10. Which current tools are most promising for controlling DSD? (From the perspective of the IS department)

Standards for Organization...
micro-Mainframe (lot)

11. What new tools are needed in the DSD environment?

Software should permit control but not dictate. (Standards needed...)
Don't abdicate responsibility...
Fourth & Fifth → Operational Systems (medium large)
(Tremendous need...)

12. How do you suggest customers measure productivity improvement?

Time to Develop...
1 - 5 ratio...
1 - 20 reports...

13. How do you cost justify tools and aids?

14. What do you think about knowledge-based or expert systems?

Back-office brokerage . . . Dictionary of terms . . .

(Haven't thought.)

15. What tools and aids are required for the development of such systems?

16. Do you think special approaches such as LISP machines or new data models are required?

17. When do you feel the research work in artificial intelligence may make a contribution to the productivity problem?

a. How will it impact the IS department?

b. How will it impact white collar productivity?

18. What is IBMs direction in improving productivity in the systems development process?

____

____

19. How effective have the following been? (Rate on the scale of 1-4):

_____	IIS	_____	DMS
_____	Stairs	_____	SQL/DS
_____	APL	_____	SPF
_____	Plancode	_____	System IPO
_____	GIS	_____	SMP
_____	ADF	_____	______________________

20. How do you view IBM's arrangement to market INTELLECT?

____

____

____

21. How will IBM's acquisition of software (either purchase or marketing agreement) impact you and you product line?

☐ Not At All

☐ Some

☐ A Great Deal

22. Do you consider IBM a potential customer (or partner) for any of your products?

a. ☐ Yes ☐ No

b. If yes, which ones? ______

c. If no, could this change in the future, and if so, when? ______

23. Do you have any additional comments concerning productivity tools and aids?

micro - ① MM Data Systems -- (PC Systems)

Integrated Packages.

② Link environment

RAM-LINK ... Data File Up & Down.

(In various formats from RAMIS)

Announced at USER

③ RAMIS XT-370 ...

Faster than Mainframe for Screen Formatting

Program Development ... Small Systems ... Reports ... (Back & Forth.)

DBManager ...

CONFIDENTIAL

INPUT QUESTIONNAIRE

CATALOG. NO. ☐☐☐☐☐☐☐
SIC. CODE ☐☐☐☐☐☐
SIZE CODE ☐☐
AREA CODE ☐☐
STUDY CODE ☐☐
DATES ☐☐☐☐☐☐
MM DD YY

STUDY TITLE:
TYPE OF INTERVIEW: ☑ VENDOR ☐ USER ☑ TELEPHONE ☐ ON-SITE ☐ MAIL

INTERVIEWER: Tim Tyler

COMPANY: Sundance Systems CO. TYPE:

ADDRESS: (Northeast Consulting Group) SALES:

NO. EMPL.:

INDUSTRY ☐

☐ DISCRETE MANUFACTURING
☐ PROCESS MANUFACTURING
☐ TRANSPORTATION
☐ MEDICAL
☐ SERVICES
☐ UTILITIES
☐ RETAIL
☐ BANKING
☐ WHOLESALE
☐ OTHER
☐ INSURANCE
☐ GOVERNMENT - FEDERAL
☐ GOVERNMENT - STATE & LOCAL
☐ EDUCATION

INTERVIEWS

NAME	TITLE	TELEPHONE NO.
I. Kelson		
M. Gothelf		

SUMMARY

REFERENCES

CATALOG NO. MSSP☐☐☐

VENDOR QUESTIONNAIRE

1. How do you define the productivity problem in the typical IS department?

   ① Failure of communication between user & technical group.

   ② All technical problems can be solved...

   a. How can the problem be scoped? Re-do, time and cost – false starts – maintenance (25-40%)

   b. How can improvement be measured? Difficult to measure... Previous projects only way, but...

2. What do you think are the most promising approaches to improving productivity in systems development and programming?

   ① re-usable modules...

   ② Better user communications

   ③ There still room for language improvement. (System 38 a major step) Both applications & systems...

   Trained technicians still required...

3. The major trend in reducing the systems and programming bottleneck has been to get end users more involved in the process. INPUT refers to this as Distributed Systems Development. How do you feel IS departments feel about the following:

   a. Information Centers Lot of professional insecurity – see it as threat.

   b. Prototyping Lot of merit – requirements never solid... let it evolve... better system.

   c. Use of Standalone PCs (for work formerly done by IS) Threat once again – sympathy because it is not professional

① competition for data
② resources
③ politics
④ Competition for development

d. Micro-Mainframe Links Preferred use for selected functions - but not main applications, similar thing with Citibank & Mini's... and it was a disaster. (positive & negative)

pendulum swings back

standards

4. We would like to get your opinions considering DSD in general. Do you agree or disagree with the following statements:

	Agree	Disagree	
It has relieved user pressure on IS	☑	☐	
End users are happier	☑	☐	
Systems get done faster	☑	☐	
Programs Get Done Faster	☑	☐	
Backlog has been (or will be) reduced	☐	☑	(absolute)
DSD help IS do its job	☐	☑	
DSD is going to cause problems	☑	☐	
End users don't know what they are doing	☐	☐	Some do some don't!
IS Productivity is improved (Conflict)	☐	☑	
End-User productivity is improved (function)	☑	☐	
Corporate productivity is improved	☑	☐	
The system will have to be rewritten by IS	☐	☐	In some cases

5. What are the main advantages and disadvantages of:

a. Information Centers

Advantages: ______________________

Disadvantages ______________________

b. Prototyping

Advantages ______________________

Disadvantages ______________________

c. Standalone PCs

Advantages

Disadvantages

d. Micro-Mainframe

Advantages

Disadvantages

6. Past research has indicated that systems maintenance is the most costly part of the systems life cycle. What impact is DSD going to have on maintenance?

It will continue to be the most expensive part. User definition and development run in parallel and maintenance disappears it is accepted, and function becomes difficult..

7. What tools and aids are currently being used to facilitate end user systems development? (Ask for both name and vendor)

NAME	VENDOR
Spread Sheets	the usual
Data base system	

There is still some animosity among systems & users — ~~there~~

CATALOG NO. MSSP☐☐☐

8. A great deal of apprehension has been expressed about micro-mainframe links. How serious do you consider the following potential problems?

	Very Serious	Somewhat Serious	Not a Problem
Data Base Synchronization	☑	☐	☐
Data Base Integrity	☑	☐	☐
User Understanding of Data	☐	☑	☐
Conflicting Reports to Management	☑	☐	☐
Mainframe Capacity Planning	☐	☐	☐
Mainframe Performance Impact	☑	☐	☐
IS Visability	☐	☑	☐
Cost to Company (net effect may not be)	☐	☑	☐ but benefits worthwhile
Impact on IS Budget (reflects on how they charge)	☐	☑	☐
Systems Quality (might get better)	☐	☐	☑ Doubt that.
IS Loss of Control (they will)	☑	☐	☐
Data Security/Protection	☑	☐	☐

9. Which current tools do you feel are most promising for facilitating DSD?

Fourth Generation Languages
Authorship Systems ...
Application Generators ...

10. Which current tools are most promising for controlling DSD? (From the perspective of the IS department)

Trend Towards more powerful data base
languages... System/38... again...
Cullinane new IDMS etc..

11. What new tools are needed in the DSD environment?

12. How do you suggest customers measure productivity improvement?

13. How do you cost justify tools and aids?

14. What do you think about knowledge-based or expert systems?

not much

15. What tools and aids are required for the development of such systems?

16. Do you think special approaches such as LISP machines or new data models are required?

17. When do you feel the research work in artificial intelligence may make a contribution to the productivity problem?

a. How will it impact the IS department?

b. How will it impact white collar productivity?

18. What is IBMs direction in improving productivity in the systems development process?

____

____

19. How effective have the following been? (Rate on the scale of 1-4):

_____ IIS

_____ Stairs

_____ APL

_____ Plancode

_____ GIS

_____ ADF

_____ DMS

_____ SQL/DS

_____ SPF

_____ System IPO

_____ SMP

_____ ______________

20. How do you view IBM's arrangement to market INTELLECT?

____

____

____

21. How will IBM's acquisition of software (either purchase or marketing agreement) impact you and you product line?

☐ Not At All

☑ Some (already has)

☐ A Great Deal (might become)

Has already impacted

22. Do you consider IBM a potential customer (or partner) for any of your products?

a. ☑ Yes ☐ No

b. If yes, which ones? All packages...

How...

c. If no, could this change in the future, and if so, when? __________

23. Do you have any additional comments concerning productivity tools and aids?

① IBM hardware driven...

② Get analyzed.. Market Assistance Program...

③ Give outside firms...

① Research to define data
② User actually to read & validate
④ Slang ... & dictionary use

Sniff Test Techniques —
Solid Core of People ...

Some things not worth doing

Central Data Bank Theoretician
versus Practicality
Armageddon of the Theoreticians

CATALOG NO. M S S P ☐ ☐ ☐

VENDOR QUESTIONNAIRE

1. How do you define the productivity problem in the typical IS department?

____

____

____

   a. How can the problem be scoped? ____________________

   ____

   b. How can improvement be measured? ____________________

   ____

2. What do you think are the most promising approaches to improving productivity in systems development and programming?

____

____

____

3. The major trend in reducing the systems and programming bottleneck has been to get end users more involved in the process. INPUT refers to this as Distributed Systems Development. How do you feel IS departments feel about the following:

   a. Information Centers ____________________

   ____

   b. Prototyping ____________________

   ____

   c. Use of Standalone PCs (for work formerly done by IS) ____________

   ____

d. Micro-Mainframe Links ______________________________

____

4. We would like to get your opinions considering DSD in general. Do you agree or disagree with the following statements:

	Agree	Disagree
It has relieved user pressure on IS	☐	☐
End users are happier	☐	☐
Systems get done faster	☐	☐
Programs Get Done Faster	☐	☐
Backlog has been (or will be) reduced	☐	☐
DSD help IS do its job	☐	☐
DSD is going to cause problems	☐	☐
End users don't know what they are doing	☐	☐
IS Productivity is improved	☐	☐
End-User productivity is improved	☐	☐
Corporate productivity is improved	☐	☐
The system will have to be rewritten by IS	☐	☐

5. What are the main advantages and disadvantages of:

a. Information Centers

Advantages: ______________________________

____

Disadvantages ______________________________

____

b. Prototyping

Advantages ______________________________

____

Disadvantages ______________________________

____

c. Standalone PCs

Advantages ______________________________

____

Disadvantages ______________________________

____

d. Micro-Mainframe

Advantages ______________________________

____

Disadvantages ______________________________

____

6. Past research has indicated that systems maintenance is the most costly part of the systems life cycle. What impact is DSD going to have on maintenance?

____

____

7. What tools and aids are currently being used to facilitate end user systems development? (Ask for both name and vendor)

NAME	VENDOR

CATALOG NO. MSSP☐☐☐

8. A great deal of apprehension has been expressed about micro-mainframe links. How serious do you consider the following potential problems?

	Very Serious	Somewhat Serious	Not a Problem
Data Base Synchronization is solvable	☑	☐	☐
Data Base Integrity awareness	☐	☑	☐
User Understanding of Data Large Org...	☑	☐	☑ intelligent ones should know
Conflicting Reports to Management	☑	☐	☐
Mainframe Capacity Planning nightmare (Internally on APL)	☑	☐	☐
Mainframe Performance Impact Additional Load--	☑	☐	☐
IS Visability More people dealing with...	☐	☑	☐ ...
Cost to Company all DP advances cost...	☐	☑	☐
Impact on IS Budget Go up. if combined...	☑	☐	☐
Systems Quality Software producers not intelligent enough	☑	☐	☐
IS Loss of Control Because of above...	☑	☐	☐
Data Security/Protection	☐	☐	☐

Incredible nightmare

not packages

In-house shops don't understand

no proper training

① modest on PC → mainframe
② Whole problem not being addressed
③ Similar to Paper Filing problem for end.

Second part of first

9. Which current tools do you feel are most promising for facilitating DSD?

10. Which current tools are most promising for controlling DSD? (From the perspective of the IS department)

11. What new tools are needed in the DSD environment?

12. How do you suggest customers measure productivity improvement?

13. How do you cost justify tools and aids?

14. What do you think about knowledge-based or expert systems?

____

____

15. What tools and aids are required for the development of such systems?

____

____

____

16. Do you think special approaches such as LISP machines or new data models are required?

____

____

____

17. When do you feel the research work in artificial intelligence may make a contribution to the productivity problem?

____

____

a. How will it impact the IS department? ____________________

____

b. How will it impact white collar productivity? ____________________

____

18. What is IBMs direction in improving productivity in the systems development process?

____

____

19. How effective have the following been? (Rate on the scale of 1-4):

_____ IIS

_____ Stairs

_____ APL

_____ Plancode

_____ GIS

_____ ADF

_____ DMS

_____ SQL/DS

_____ SPF

_____ System IPO

_____ SMP

_____ ____________________

20. How do you view IBM's arrangement to market INTELLECT?

____

____

____

21. How will IBM's acquisition of software (either purchase or marketing agreement) impact you and you product line?

☐ Not At All

☐ Some

☐ A Great Deal

22. Do you consider IBM a potential customer (or partner) for any of your products?

a. ☐ Yes ☐ No

b. If yes, which ones? ______________________________

____

c. If no, could this change in the future, and if so, when? __________

____

23. Do you have any additional comments concerning productivity tools and aids?

____

____

____

____

Gopal

Five-six years ago structures   not solved
then Prototypes - -   "   "
Fourth Generation Languages (Budgets spent)   "   "
then something new...
External Diversions (like dictator) to distract source of unrest.

Information Center
Micro - Mainframe Links

All of above could be aids but not solutions.

⑭ Prototypes
ⓐ A means of identifying their needs. (A solution to problem changes problem)
(Physical Images of thoughts)
ⓑ Once one selected – verify the needs...
→
ⓒ How to build, buy etc ... (May be prototyped)
ⓓ Database prototype (Hierarchical, Relational)
for one department...
Good tool in areas where there is unfamiliarity or unknown.
ⓔ And naturally on human factors...
Prototypes encourages changing minds...
[Looking for perfection - - never make a decision
small (eternal design)
Computer at work...

Gopal 7/26/84

① Warning on Product..

② DP Filter User → DP → User

③ Analysis & Conceptual Design being removed.

④ No conceptual design — no integrity (data & system)

⑤ Warehouse example (user not understanding)

⑥ Corporate Data / Information & Survival.

   ⓐ Order Data was of DP emphasis...

   ⓑ Reports then become a question of style.
      & not associated with time & use
      (as managers change).

⑦ Life-cycle Methodology (Conceptual Design)...

   ⓐ Minimum information to survive.
      " " for audit.

⑧ Actual

   ⓐ Pockets of Data Bases (Well Guarded)

   ⓑ Eighteen little data base

   ⓒ Politics (Example Rolodex eighteen different salesmen)

⑨ "De-coupling" of DP — first thing is to fire DP people when decentralized.

⑩ Education is really a problem because (decentralized) of small budgets. Fragmented can't learn and different sources cause confusion...

⑪ Auditors — Accounting combined at Lloyds house.

⑫ Micros for development (not being used by DP)...

⑬ Technical Solution — Aids-Yes Solution — No...
   Even automatic systems development won't solve the problem.

CATALOG NO. MSSP☐☐☐

VENDOR QUESTIONNAIRE

1. How do you define the productivity problem in the typical IS department?

    a. How can the problem be scoped?

    b. How can improvement be measured?

2. What do you think are the most promising approaches to improving productivity in systems development and programming?

3. The major trend in reducing the systems and programming bottleneck has been to get end users more involved in the process. INPUT refers to this as Distributed Systems Development. How do you feel IS departments feel about the following:

    a. Information Centers

    b. Prototyping

    c. Use of Standalone PCs (for work formerly done by IS)

d. Micro-Mainframe Links ______________________

4. We would like to get your opinions considering DSD in general. Do you agree or disagree with the following statements:

	Agree	Disagree
It has relieved user pressure on IS	☐	☑
End users are happier	☑	☐
Systems get done faster	☐	☑
Programs Get Done Faster	☐	☑
Backlog has been (or will be) reduced	☐	☑
DSD help IS do its job	☑	☐
DSD is going to cause problems	☑	☐
End users don't know what they are doing	☐	☐ Too Strong
IS Productivity is improved	☐ selection	☑
End-User productivity is improved	☑	☐
Corporate productivity is improved	☐	☑
The system will have to be rewritten by IS	☑ majority	☐

5. What are the main advantages and disadvantages of:

a. Information Centers

Advantages: Good concept - education.. ,

Disadvantages Begin to use for production (Set up on centralized basis - return on investment... - a mere P/C

b. Prototyping

Advantages ______________________

Disadvantages ______________________

c. Standalone PCs

Advantages One per Programmers & Users a few for familiarity

Disadvantages

d. Micro-Mainframe

Advantages Down load & Up-load programs.

Disadvantages

6. Past research has indicated that systems maintenance is the most costly part of the systems life cycle. What impact is DSD going to have on maintenance?

Will make it more expensive...

(Prototypes will make for less --)

7. What tools and aids are currently being used to facilitate end user systems development? (Ask for both name and vendor)

NAME	VENDOR
micros...	
DB2 - Focus Ramis etc.	

8. A great deal of apprehension has been expressed about micro-mainframe links. How serious do you consider the following potential problems?

	Very Serious	Somewhat Serious	Not a Problem
Data Base Synchronization	☑	☐	☐
Data Base Integrity	☑	☐	☐
User Understanding of Data	☐	☑	☐
Conflicting Reports to Management	☑	☐	☐
Mainframe Capacity Planning	☑	☐	☐
Mainframe Performance Impact	☑	☐	☐
IS Visability will lose glamour	☐	☑	☐
Cost to Company (more controls)	☐	☑	☐
Impact on IS Budget	☐	☐	☑
Systems Quality	☐	☑	☐
IS Loss of Control	☐	☑	☐
Data Security/Protection	☑	☐	☐

9. Which current tools do you feel are most promising for facilitating DSD?

micros - - in Information Centers
Fourth Generation

10. Which current tools are most promising for controlling DSD? (From the perspective of the IS department)

Security is ~~the means for~~ difficult to control . . . Strong DBS and Dictionary . . .
Physical Separation . . .
more knowledge of Information Flow problems.

11. What new tools are needed in the DSD environment?

nothing new (Information Flow)
(no substitute for good design)
(Problems of non-professional attitudes — not artists)

12. How do you suggest customers measure productivity improvement?

① Delivery, Date, money & schedule,
② Performance After — Failure rate,
③ ~~B~~ End user . . , Satisfaction . . .
Tree Stumps Examples . . . Can Give
artificialities of Inaccurate Information . . .

13. How do you cost justify tools and aids?

14. What do you think about knowledge-based or expert systems?

One more attempt to divert attention from problem

15. What tools and aids are required for the development of such systems?

AI - LISP...

Data Synthesis Tools,

16. Do you think special approaches such as LISP machines or new data models are required?

17. When do you feel the research work in artificial intelligence may make a contribution to the productivity problem?

Doesn't Know...

a. How will it impact the IS department? —

b. How will it impact white collar productivity?

18. What is IBMs direction in improving productivity in the systems development process?

Internally they work; but translation does not work... Part of it is Education and willingness to do research.
Software – fly in formation...

19. How effective have the following been? (Rate on the scale of 1-4):

_____ IIS
_____ Stairs
_____ APL
_____ Plancode
_____ GIS
_____ ADF

_____ DMS
_____ SQL/DS
_____ SPF
_____ System IPO
_____ SMP
_____ _____________________

20. How do you view IBM's arrangement to market INTELLECT?

Don't know?..

21. How will IBM's acquisition of software (either purchase or marketing agreement) impact you and you product line?

☐ Not At All
☐ Some
☐ A Great Deal

22. Do you consider IBM a potential customer (or partner) for any of your products?

a. ☐ Yes ☐ No

b. If yes, which ones? ______________________________

____

c. If no, could this change in the future, and if so, when? __________

____

23. Do you have any additional comments concerning productivity tools and aids?

____

____

____

____

Limitations

① Creep into production

② Language not suitable for change —
can re-do but not change (4th Generation)

1- Technical "experts" no longer expert
User Ignorant and still...

Suspect mgmt... < Programmers and Analysts → Do not respect mgmt.

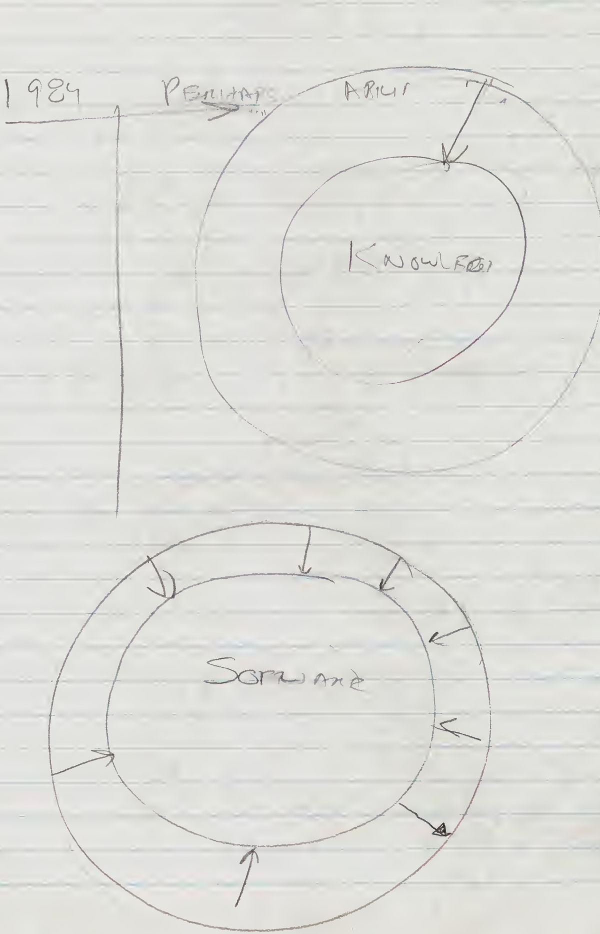
DP mgrs. need to invest... Time in keeping up to date.

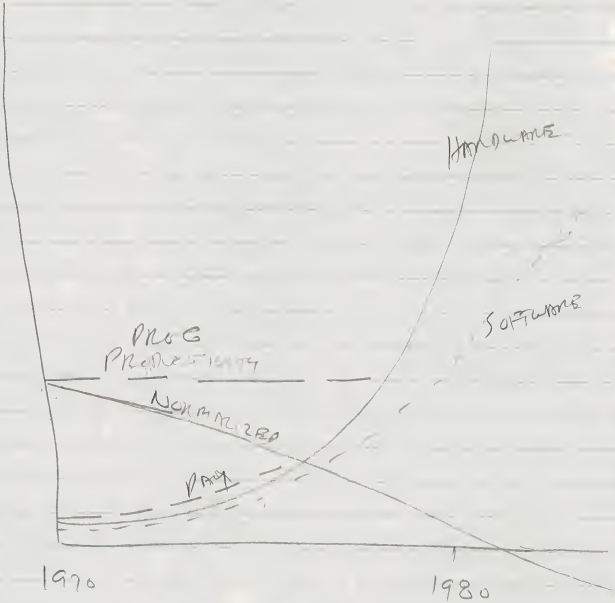
DP mgmt (if not involved in DSD) have a short and limited future.

This phenomenon is recent (last 2-3 years) ...

Walk-through as a concept not understood
(Basic QC — Major systems with no check points)

1- Read & remain knowledgeable (requirements for reading & education)
2- Bonus dependent — specs used.


1984
PERHAPS
ABOUT
KNOWLEDGE
SOFTWARE


HARDWARE
SOFTWARE
PROG PRODUCTIVITY
NORMALIZED
PAY
1970
1980

[redacted]

A REPRINT FROM THE JULY 16, 1979 ISSUE OF

COMPUTERWORLD

[redacted]

A Cookbook Approach To Structured Methodology or With Five You Get Top Down Coupling

By Gopal Kapur

IN DEPTH

To teach a seminar (or to give a management presentation) on structured analysis, structured design or structured *anything* , always start with a data flow diagram or Nassi-Schniederman diagram or a bubble chart or Warnier diagram or a hierarchical chart — never a flowchart (too passe)

Fill the circles or blocks with Greek letters. With tough audiences, Sanskrit and Phoenician symbols have had a more desirable (intimidating) effect.

Next, add primes and bars to any English letters you might have used. Use Roman numerals, preferably starting with a number close to XXIV, since most people can only figure up to XIV. Thus, more intimidation. MCMLXVI devastates even the best.

Next, use an obscure (and by all means, don t explain) convention of shading and striping involving at least three colors and refer to your convention as the ' international convention" of representing data flow, automation, transform and transaction analysis. (Now is a good time to go into detailed discussion of *I'm OK, You're OK, The Grass Is Always Greener Over the Septic Tank, The Hite Report* and *The Kamasutra*)

While drawing the diagram, make remarks such as, "Any analyst should know these conventions, since even seventh graders are familiar with them ' This will complete your "top-down intimidation" of the audience. Now, you are ready to begin your lecture!

'Structured analysis and transform analysis are not strategies of design, but are simply ways to switch gears to think of continuous levels of abstractions which will allow us to identify the afferent and efferent to the central conversion module, keeping in mind the parallelism of datum.

"However, transform analysis only helps you in the input and output legs of the mudular afferent/efferent analysis. Nonetheless, it helps you dissect diametrically opposed pieces of the central transform into structure charts which will then give you insight into the pathological data connections and neurological control structures existing between various levels of abstraction

"By repeating this process concurrently, you will be able to see the light at the end of the tunnel. The inner transform center must be small enough to conduct transaction analysis but not too big to exceed your "hrair" limit.

"You will now be ready to start with initial stages of final structure analysis, which of course is repetitive iteration of transaction analysis tampered with transform analysis. This initial stage of structure analysis will produce a central transform whose peripheral cohesion may "stink" a bit, but its coupling should be fairly acceptable

"At this time, be careful of the tremendous amount of fanout from the central transform center as this type of fanout will certainly lead to noncohesive cohesion and a highly coupled intermodule structure with commonality of subschemas. The natural inclination of data is to lean to the left, but as the afferent is to the right, the conflict may lead to a sagging morphology (film at 11)."

If anyone asks a question at this time or wants some clarification of the methodology, a good answer is: "This is really not a strategy, but more of an observation Nonetheless, it is supported by a large number of proponents of structured methodology." (Drop some names here: Dijkstra, Parnes, Knuth, Saheeb, Prof. Corey, Mills, and so on. A good followup comment is, "This falls out so naturally that it should be completely obvious to you.")

Now continue: "Neither transform analysis, transaction analysis, bubble charts nor structure charts work everywhere. But as you all know, the knowledgeable practitioners have observed that portions of these work everywhere."

Notice the use of the work "observed" in the last sentence. Never say "written." Such definitive statements will get you in trouble. Participants will ask for references, thus creating an uncomfortable situation for you. Who needs it? The use of the word "observed" implies that you have certain inside knowledge of what these people are saying. In fact, it is a good idea to imply to the audience that you talk to these people often.

"So transform and transaction analysis can help you get started with an initial structure chart (level 0 minus 1, and counting) and fan-in inversion investigation providing that you have properly understood and defined the afferent and efferent of the outer transform analysis of the inner transaction centers. Now that we have a fairly well developed structure chart, the next step is to start decomposing the highly cohesive levels of abstractions in order to define the parallelism of data.

"Next, syntactical analysis is very critical if the fan-in (Sally Rand, where are you?) analysis indicates that the scope of effect and scope of control conflict with the overall morphology of the heuristical algorithm of the left-leaning modular afferent. Now that the preliminary morphology of the intermediate structure chart has been established, you can proceed with extrapolation of data flow in order to arrive at the final structure chart."

Class Participation

This is a good point in time to ask the class to develop a data flow diagram using the bubble chart method. Warn the students to keep in mind the transform analysis, transaction analysis, scope of effect and control, afferent and efferent and the sagging morphology that may result if they are not careful about the pathological data parallelism Wait a few minutes and collect class solutions

Now display your *partial* solutior to the problem Tell the class that this is not the ultimate solution, because there is no ultimate solution. Don't criticize any particular solution (developed by the participants) as being totally bad, neither accept any individual solution as the best approach.

It is a safe policy to partially accept and partially reject each solution (this way no one is completely offended yet they will look forward to the ultima solution from you which of cours you will never give).

Tell the class that if you were to take the good parts of the various class solutions and put them together in a well structured puzzle you would have something very close to the correct solution.' (Good time to play Instant Insanity, Master Mind and the Moroccan Ring games Practically no one will be successful, thus more intimidation.)

Be sure to warn the class about the bad side effects whenever there is a tendency to mix cohesion with coupling and that the top-down approach may lead to excessive front-out of modules which have poor afferent in the input modules If improved coupling does not result, increase the nodules on your gismo (inside a plain brown wrapper, of course).

If questioned, a good remark would be, 'This, of course, is not the final solution as I still have to do further refinement by applying the transform and transaction analysis, keeping in mind the reasonable approach of cookbook methodology of structured analysis and design '

Now, make the following observation (don't forget, it is an observation and not a definitive statement) Context editing and content analysis have the parallelism of poor cohesion and not-so-acceptable coupling while afferent and efferent of the output le have better coupling and not-so acceptable cohesion Therefore, I will at this point in time, establish a new level of abstraction while pushing the structure stack downwards a level (point to a *large* portion of your sample solution) and establishing a higher level of abstraction, thereby facilitat-

Dedicated to oral flashers of structured methodology, with apologies to Edwin Newman.

[illegible] the process of stepping from transaction analysis to transform analysis.

"This process will lead to a data flow diagram with a desirable morphology while still not violating the heuristics of the algorithm Now, what we have here replaces the two editing cor exts into a single more heuristically valid cross-edit which will make the user understand the pathological controls leading to excessive fan-out of the pushed-in central module."

If asked a question, repeat the question while modifying it a bit and remark. I will be happy to go back and explain the morphology of structures using Bohm and Jacopini coding constructs keeping in view what Dijkstra has really promised to write about in his new text (this implies that Dijkstra privately consults with you), provided that you have a clear understanding of Myers methodology of composite design."

Time for Harangue

At this time, go into an impassioned harangue condemning COBOL as unfit for structured programming Talk about the days when you wrote ALGOL and played with SNOBOL and how you long for the opportunity to do so again. this will intimidate all those who use COBOL and will keep them from questioning your abilities

If a question still exists, listen intently while tapping your fingers on the desk or twirling your pencil, snickering occasionally while looking around impatiently. A well-tried answer is "Now then, there is nothing cookbook about the methodology, but what we really need here is a clearer understanding and application of data flow diagrams, structure charts, program morphology, pathological data connections, neurological control constructs, module afferent and efferent and heuristics of the module functions."

Then continue with, "If you would like. I would be glad to start over again' and further remark that "any good programmer should have understood the simple concepts long ago." This will take care of even the most persistent student.

Where were we? Oh yes, stacks of algorithmic fan-outs. The next important step is to investigate the Hipo methodology. Since we all know that Hipo was IBM's invention, it is very easy to take potshots at the entire methodology It is an easy way to get laughs, and no effort should be spared at this time to make jokes at IBM's expense

You will notice that the class is quite grim by now, so go to it. A good leading question to ask is, "Do you know what Hipo really stands for?" Some of the participants will venture the usual explanation, Hierarchical Input Pro[illegible] Output.

Produce a smug smile and shake your head Then say, "It really means How IBM Puts you On." Laughter, another triumph for you.

If the audience responds well to your last remark, quickly go into the controversy of Chapin charts vs. Nassi-Schniederman charts. Give references to the Association for Computing Machinery SigPlan Notices, August 1973, then refer to Chapin's paper on Chapin charts and immediately read from letters to the editor (ACM publications) chiding Chapin for renaming the charts. This will get you snickers from the class, and you will have impressed at least a few people by your razor-sharp wit

Back to Hipo Make remarks like "Nobody I know has been happy with the methodology' Make certain that you don't identify anyone. The all-encompassing word 'they' works the best

Give references of certain companies and groups at least 1,000 miles away from the site of the current class Examples of foreign countries, especially European, are very impressive. (Examples of countries and places such as Namibia. Hicksville. Nagaland, Fresno, Kaithal and Uganda have not had the desirable effect, hence, should be avoided)

Getting More Abstract

Now you need to deal with more abstract design, keeping in view more abstract data definitions This will lead your class to analysis of cogitation of cohesive data with a view to partition transactionally transformed data into a top-down inverse matrix of sequential subschemas.

These transactionally transformed sequential subschemas can then be appended to the afferential control structures containing subschemas, thereby giving us a very clear understanding of the hierarchical control structures, linear data flow, tangential control coupling, along with substacks of data transform modules.

You must, however, point out that a change that happens to fall into the lower levels of abstractions of the top-down structures will lead to a structure with severe pathological morphology containing excessive fan-outs and progressive regression.

This type of progressive regression, combined with a total lack of control flags being passed at higher level modules, keeps the intermediate stubs at a recursive level of transform flux (try Kaopectate), thus damaging the intermodule coupling as well as affecting the fan-in of the pathologically sound inner transform centers, which of course, is a very undesirable approach to solving programming problems.

However, this is not per se a design consideration but has a profound influence in some cases related to overall systems design and program development.

A possible question from one of the participants might be (some people never give up): "Does this methodology apply specifically to day-to-day program design? After all, that is what my responsibility is."

Your answer at this time should be: "Let me not answer this question at this point in time and in fact let us not even talk about programs and systems but let me talk about the whole thing. Because it applies to individual stubs, it is a clear game, or should be, that many of the stubs are trivial logic drivers

"However, from the projects we were involved in, in Afghanistan and Bhutan, we learned that our first step should be to build the most important stubs by taking appropriate strips from each stub while avoiding the uglier transient modules The selected outer strips should be combined with not-yet-coded subordinates which may at times pervert the data flow graphs of the outer strips, thereby voiding the upper levels of logic drivers which should have been pushed down the shelf during the first level of structured walk-through."

Then ask if there are any more questions No one will dare — you're safe

Family Stubs

"The next important subject deals with performance criteria in relation to data flow volumes. In order to develop a basically reliable performance criteria, we need to focus our attention on the parent and child stubs (also known as the family stubs — LTAs don't count). Child stubs are easier to write than the driver (or parent) stubs, which of course doesn't hold true every time, thereby requiring us to further investigate the pairwise integration of interfaces between the subtrees

"Unfortunatey, this pairwise intergration investigation involving inverted indices invariably inverses the initial performance budgets inaeternum indicating insufficient initial performance budgets inaeternum indicating insufficient interactions in between individual interfaces. Hence, it should be avoided.

"Therefore, one needs to be extremely careful that the lower level stubs are not comsuming most of the allocated performance and time budgets. If this is allowed to happen, the parent stubs will require much more phased oriented integration time, thus adversely affecting the initial performance criteria.

"The next step in structured analysis is to develop a high-level strip with properly visible arrows (depicting afferential data flows). This can be easily accomplished when the lower level of strip arrows is fanned out into appropriate second and middle level transform structures with properly fanned out structure strips.

"This iterative phased striping and restriping of successive top-down structures will lead to a well-balanced top-down-oriented chart which should have a preagreed-upon morphology of log n-1 fanouts and incurvate upward mobility of central data and transformed subschemas.

"Now that a fairly well balanced structure has been developed, we are ready to go into our second phased walk-through (or walk-on) to properly ascertain the man-machine interfaces."

Starting with the morning of the last day of the class, make remarks like "You know, usually we have several workshops during this seminar, but unfortunately we don't have the time because the class has been progressing rather slowly This remark will generate guilt among the participants and you can make your point by addressing those who have had the affrontery and effrontery to interrupt the class with confusing questions

Now continue "The design process is not over In fact even structured analysis is not over yet What we need to do next is define data requirements and do data flow analysis However, as I mentioned on the first day, the subject of data flow analysis is beyond the scope of this seminar and as such will not be discussed (now is a good time to announce your next seminar on data flow analysis)

"The last, but certainly not the least, step in structured analysis deals with the subject of program flags. It has been our experience that improperly cohesive data and control flags create partially coupled hybrid flags (these are the flags that can't have little flags of their own) which, in the absence of default parameters, may need to be debriefed. Default parameters should be avoided as they tend to travel at turtle-like speeds, thereby making the process of debriefing very frustrating but nonetheless rewarding Now, the analysis phase is completed."

By following these clear guidelines, you will follow in the tradition of those great instructors who through their clear thinking and lucid writing have helped make DP what it is today.

Kapur is president of Kapur & Associates, Inc. and consults, teaches and writes in the fields of information systems management, project management and programmer productivity

His firm serves clients in the U.S., Canada, Europe, South America and Asia, specializing in the application of innovative methods to help solve DP problems.

Kapur graduated summa cum laude *from Thapar Institute of Engineering (India) and is listed in* Who's Who in the West

6

CONFIDENTIAL

INPUT QUESTIONNAIRE

CATALOG. NO. M S S P
SIC. CODE
SIZE CODE
AREA CODE
STUDY CODE
DATES
MM DD YY

STUDY TITLE:
TYPE OF INTERVIEW: ☑ VENDOR ☐ USER ☐ TELEPHONE ☐ ON-SITE ☐ MAIL

INTERVIEWER: Tim Tyler

COMPANY: Pangram (

CO. TYPE:

ADDRESS: P. O. Box 30308

SALES:

NO. EMPL:

INDUSTRY ☐

☐ DISCRETE MANUFACTURING
☐ PROCESS MANUFACTURING
☐ TRANSPORTATION
☐ MEDICAL
☐ SERVICES
☐ UTILITIES
☐ RETAIL
☐ BANKING
☐ WHOLESALE
☐ OTHER
☐ INSURANCE
☐ GOVERNMENT - FEDERAL
☐ GOVERNMENT - STATE & LOCAL
☐ EDUCATION

INTERVIEWS

NAME	TITLE	TELEPHONE NO.
William Blair		919 481-1372

SUMMARY Software Development... 2-3 products
sell 1,000 lucky 200-400... Throwing Hardware
I/O subsystems in 90%... solutions at problem
People Management... [Visaible... (I I I I I)]

REFERENCES

CATALOG NO. MSSP☐☐☐

Bill Blair
919 481-1372

VENDOR QUESTIONNAIRE

1. How do you define the productivity problem in the typical IS department?

   a. How can the problem be scoped?

   b. How can improvement be measured?

2. What do you think are the most promising approaches to improving productivity in systems development and programming?

3. The major trend in reducing the systems and programming bottleneck has been to get end users more involved in the process. INPUT refers to this as Distributed Systems Development. How do you feel IS departments feel about the following:

   a. Information Centers

   b. Prototyping

   c. Use of Standalone PCs (for work formerly done by IS)

d. Micro-Mainframe Links ____________________

____

4. We would like to get your opinions considering DSD in general. Do you agree or disagree with the following statements:

	Agree	Disagree
It has relieved user pressure on IS	☐	☐
End users are happier	☐	☐
Systems get done faster	☐	☐
Programs Get Done Faster	☐	☐
Backlog has been (or will be) reduced	☐	☐
DSD help IS do its job	☐	☐
DSD is going to cause problems	☐	☐
End users don't know what they are doing	☐	☐
IS Productivity is improved	☐	☐
End-User productivity is improved	☐	☐
Corporate productivity is improved	☐	☐
The system will have to be rewritten by IS	☐	☐

5. What are the main advantages and disadvantages of:

a. Information Centers

Advantages: ____________________

____

Disadvantages ____________________

____

b. Prototyping

Advantages ____________________

____

Disadvantages ____________________

____

c. Standalone PCs

Advantages ______________________________

____

Disadvantages ______________________________

____

d. Micro-Mainframe

Advantages ______________________________

____

Disadvantages ______________________________

____

6. Past research has indicated that systems maintenance is the most costly part of the systems life cycle. What impact is DSD going to have on maintenance?

____

____

7. What tools and aids are currently being used to facilitate end user systems development? (Ask for both name and vendor)

NAME	VENDOR

8. A great deal of apprehension has been expressed about micro-mainframe links. How serious do you consider the following potential problems?

	Very Serious	Somewhat Serious	Not a Problem
Data Base Synchronization	☐	☐	☐
Data Base Integrity	☐	☐	☐
User Understanding of Data	☐	☐	☐
Conflicting Reports to Management	☐	☐	☐
Mainframe Capacity Planning	☐	☐	☐
Mainframe Performance Impact	☐	☐	☐
IS Visability	☐	☐	☐
Cost to Company	☐	☐	☐
Impact on IS Budget	☐	☐	☐
Systems Quality	☐	☐	☐
IS Loss of Control	☐	☐	☐
Data Security/Protection	☐	☐	☐

9. Which current tools do you feel are most promising for facilitating DSD?

____

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____

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10. Which current tools are most promising for controlling DSD? (From the perspective of the IS department)

____

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11. What new tools are needed in the DSD environment? ______________

____

____

12. How do you suggest customers measure productivity improvement?

____

____

____

13. How do you cost justify tools and aids? ______________

____

____

14. What do you think about knowledge-based or expert systems?

____

____

15. What tools and aids are required for the development of such systems?

____

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____

16. Do you think special approaches such as LISP machines or new data models are required?

____

____

____

17. When do you feel the research work in artificial intelligence may make a contribution to the productivity problem?

____

____

   a. How will it impact the IS department? ____________________

   ____

   b. How will it impact white collar productivity? ____________________

   ____

18. What is IBMs direction in improving productivity in the systems development process?

____

____

19. How effective have the following been? (Rate on the scale of 1-4):

_____ IIS

_____ Stairs

_____ APL

_____ Plancode

_____ GIS

_____ ADF

_____ DMS

_____ SQL/DS

_____ SPF

_____ System IPO

_____ SMP

_____ ____________________

20. How do you view IBM's arrangement to market INTELLECT?

____

____

____

21. How will IBM's acquisition of software (either purchase or marketing agreement) impact you and you product line?

☐ Not At All

☐ Some

☐ A Great Deal

22. Do you consider IBM a potential customer (or partner) for any of your products?

    a. ☐ Yes ☐ No

    b. If yes, which ones? ____________________

    ____

    c. If no, could this change in the future, and if so, when? __________

    ____

23. Do you have any additional comments concerning productivity tools and aids?

    ____

    ____

    ____

    ____

CONFIDENTIAL

INPUT QUESTIONNAIRE

CATALOG. NO. ☐☐☐☐☐☐☐
SIC. CODE ☐☐☐☐☐☐
SIZE CODE ☐☐
AREA CODE ☐☐
STUDY CODE ☐☐
DATES ☐☐☐☐☐☐
MM DD YY

STUDY TITLE:
TYPE OF INTERVIEW: ☑ VENDOR ☐ USER ☐ TELEPHONE ☐ ON-SITE ☐ MAIL

INTERVIEWER: Tim Tyler

COMPANY: SAS

CO. TYPE:

ADDRESS:

SALES:

NO. EMPL:

INDUSTRY ☐

☐ DISCRETE MANUFACTURING
☐ PROCESS MANUFACTURING
☐ TRANSPORTATION
☐ MEDICAL
☐ SERVICES
☐ UTILITIES
☐ RETAIL
☐ BANKING
☐ WHOLESALE
☐ OTHER
☐ INSURANCE
☐ GOVERNMENT - FEDERAL
☐ GOVERNMENT - STATE & LOCAL
☐ EDUCATION

INTERVIEWS

NAME	TITLE	TELEPHONE NO.
Ione Conkling		(919) 467-8000
Doug CoKarell		

SUMMARY

REFERENCES

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Bucyrus-Erie Co.	414-768-487 ? Ronald Hund, mgr. DP	WI
Hoover-NSK Bearing Co.	313-761-9500 Thomas Klein, mgr, IS	MI
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✓Merck & Co.	201-574-4963 Bruce Hawthorne Dir, Comm. & Planning	NJ
✓Chrysler	302-453-5390 Donovan McName DP mgr.	DE
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S+C Electronic Co.	(312)338-1000 Phillip Louser mgr. MIS	

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Conn Mut. Life Ins.	203-727-6500 David Zelie Dir, DP	CN
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mallory Components ~~3029~~		Dennis Pope Dir, MIS 317-261-1487
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Sigma Instruments MA	617-843-5000 Paul Meallo Mgr. Syst + DP

Waldenbooks CN	Terry Kelly Dir MIS	203-356- 7577
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Hanna Mining OH	216-523-3320 F.E. Banks Mgr., Systems	
Cameron Mut. Ins. MO	Kent Osborn V.P. Accts. 816-632-2135	
Iowa N+l Ins Co IA	(319)398-1200 Darrell ~~[illegible]~~ Mestdagh VP, D.P.	
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City of Tulsa, OK

Leslie Faulkner
Dir, MP+S Dept
918-581-5371

Oak Cliff Bank
TX

Ken J. Wengler
Sr. VP (214) 948-2104

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(303) 623-2500 x288
J.C. ~~B~~(k)? Rehrer
mgr, D.P.

Nevada Power

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Dir, MIS

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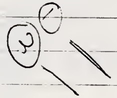
SF 94105

Jeanne Little
EDP mgr.
957-2045

Sperry Univac
3333 Scott Blvd.
Santa Clara



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Mgr. Data Base
(408) 496-3333

Kelsey Hayes
38481 Huron River
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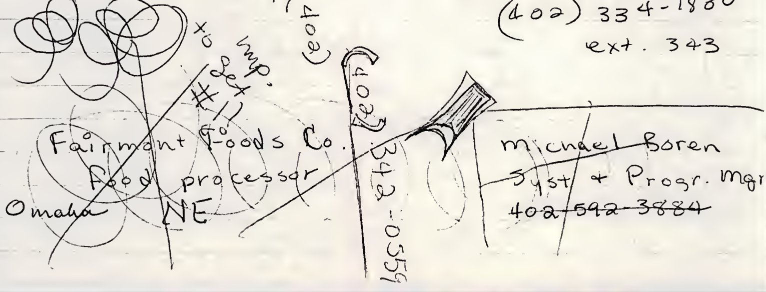
mfg. auto sppls.

Melvin Spackey
Dir. MIS
313-941-2000

Blue Cross Blue Shld.

David Mitchell
Dir Data Svss.
(402) 334-1800
ext. 343



xo imp. Set #11

(408)

(408) 342-0559

Fairmont Foods Co.
Food processor
Omaha NE

Michael Boren
Syst + Progr. Mgr
~~402-592-3884~~

Pacific Press Publ. Assoc.
1350 Villa St
Mt View 94042

L.V. Hawkins Mgr DP (415)961-2323 ?
ext 219

Sun-Land Marketing
PO Box 2268
MP CA 94025

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G.L. Weeks
Dir, Info Syst.

California Dental Svs.
1235 Mission
San Fran 94103

Mr. Rene Remy
Dir Data Serv.
415-864-9800

4x776

IBM
Software >
Hardware >

David Tommela	SCE	(213) 572-3530
Lori Wite? will call 7/17, 7/18, 7/19		11:00 -- Monday
Roger Sisson	Mathematica	(609) 799-2600
✓ Mark Gothelf & Irv Kelson	Sundance Systems	
✓ Dennis Vohs 7/18	MSA	(404) 239-2000
Marsha Russo 7/17, 7/18, 7/19		
Bill Blair (Ione Cockerell) P.O. 30308 Raleigh, N.C. 27622	SAS	(919) 467-8000
Robert Gray	Singer	
G. C. Durand	Southern Railway	(404) 529-1697
John Roe	Citizens & Southern	(404) 581-2519
Len Strobel	UNC	(919) 966-1581
✓ Tom King called 7/17, 7/18	McGraw-Hill	212 512-3190 ~~(609) 448-1700 x5624~~ N.J. 609 426-5000 x 5039
Bob Dadd	Continental Insurance	(201) 981-4539

7/23

Tom O'F...

① Topeka, Kansas
Ken Orr Associates
Emmett Wallack
(913) 273 0653

Data Flow,
Function Flow,
Specs.